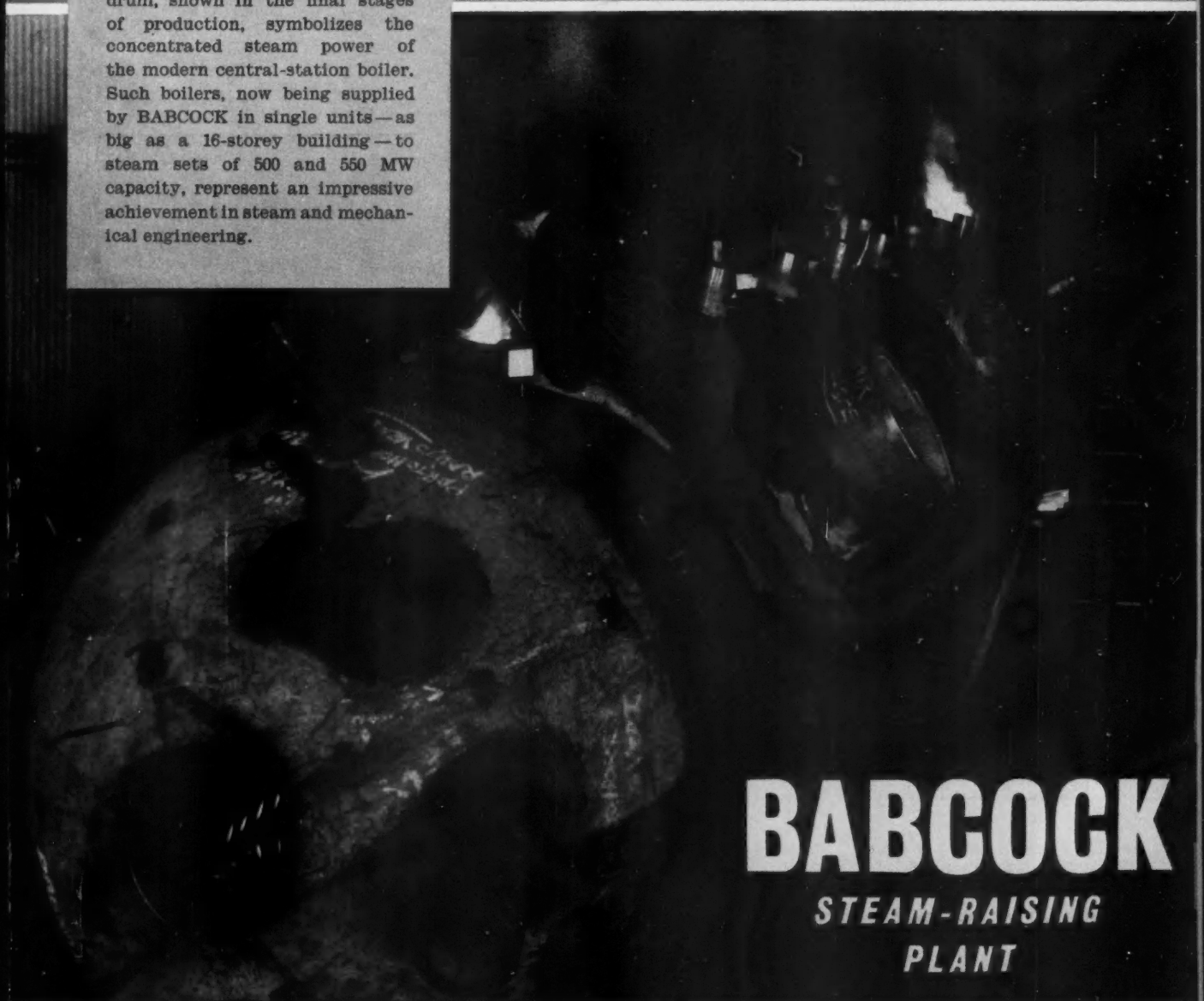
14 SEPTEMBER 1961

ONE SHILLING AND SIXPENCE

ELECTRICAL TIMES

POWER
IN PRODUCTION

This 150-ton fusion-welded boiler drum, shown in the final stages of production, symbolizes the concentrated steam power of the modern central-station boiler. Such boilers, now being supplied by BABCOCK in single units—as big as a 16-storey building—to steam sets of 500 and 550 MW capacity, represent an impressive achievement in steam and mechanical engineering.



BABCOCK
STEAM-RAISING PLANT

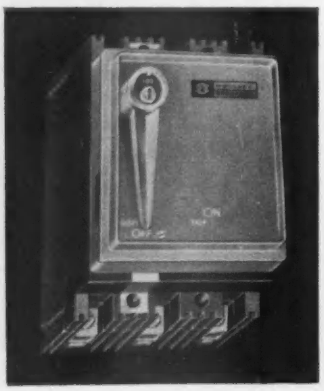
BABCOCK & WILCOX LIMITED, BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W.1

E.C.C. MOULDED BREAKERS

BRITISH MADE TO BRITISH REQUIREMENTS

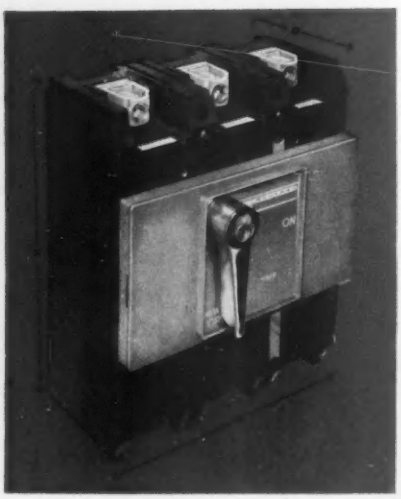
moulded-case air circuit-breakers 15 to 800 Amps

save ★ space ★ cost ★ time



NEF 100

Valuable Space Saving for Hospitals, Offices, Blocks of Flats, Multiple-Stores.



NJL 400

Delivery—Ex Stock.

Ease of Assembly into MV Switchgear

NM 800

Ref.	Range Amps	H (Height)	W (Width)	D (Depth)	Volts
NEF	15-100	7½"	4⅝"	4½"	250v. DC 440v. AC
NFL	15-225	9¾"	4⅝"	5¾"	250v. DC 600v. AC
NJL	70-400	18"	8"	9⅛"	250v. DC 600v. AC
NM	125-800	19½"	8"	9⅛"	250v. DC 600v. AC

E.C.C. MOULDED BREAKERS LIMITED

FORDHOUSE ROAD WORKS · WOLVERHAMPTON

Telephone: Wolverhampton 32521 Telegrams & Cables: "Electric, Wolverhampton"

FPE

MB 1011/PA

BRYANT & MAY'S

DE HAVILLAND

FRIGIDAIRE
REGD. T.M.

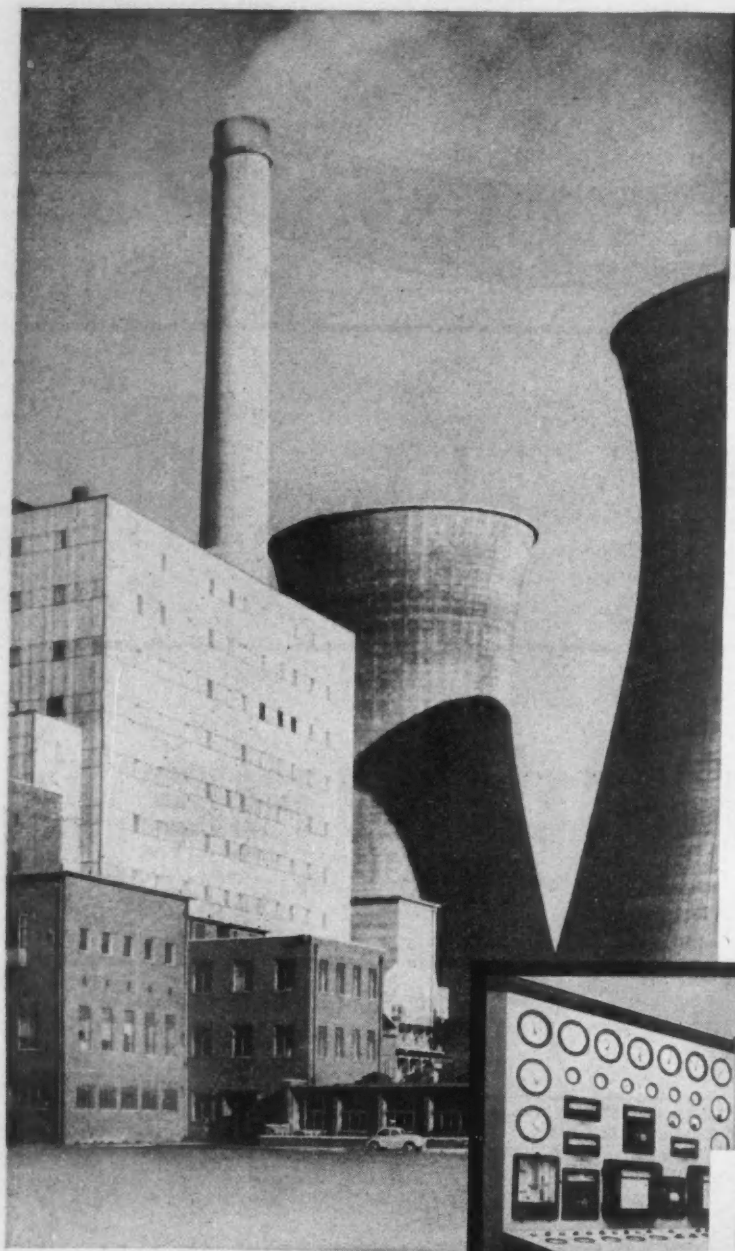
WHAT DO THESE FAMOUS NAMES HAVE IN COMMON?

OTTERMILL

OTTERMILL SWITCHGEAR LIMITED

Sales Office: 166 Victoria Street, London, S.W.1 · Telephone: ABBey 5095-6 · Telegrams: Busbar, Sowest
Works: Ottery St. Mary, Devon · Telephone: Ottery St. Mary 500 · Telegrams: Busbar Ottery St. Mary

Leading manufacturers of SWITCHGEAR, BUSBAR TRUNKING & RISING MAIN SYSTEMS



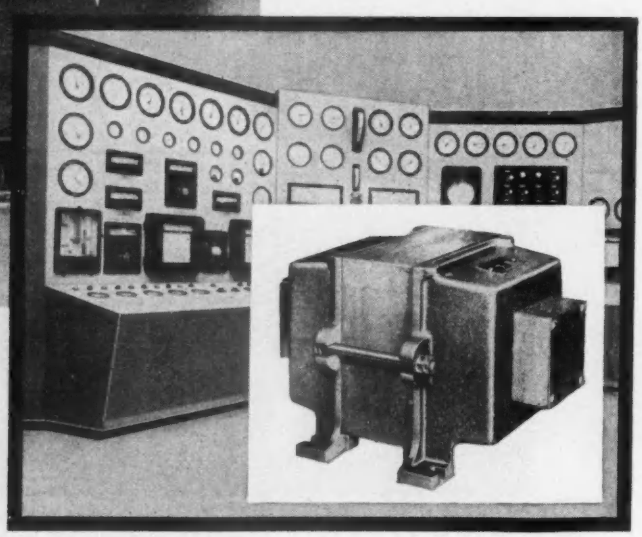
ZENITH

The second illustration shows a typical Kent instrument panel forming the basis of a composite automatic control scheme. When remote indication is required for the Kent R.SC. rotary shunt totalizing steam meter, *ZENITH fixed ratio transformers are used to provide the power for an additional integrator. A similar supply source is used for water, air and gas.

Reliability in the smallest of components is essential to smooth and safe working. This quality is built into our transformers which are available up to 35 kVA, both single and three-phase, types A.N. and O.N. Our experience is at your service when the difficult single application causes cogitation.

*Registered Trade Mark

Photographs by courtesy of the Central Electricity Generating Board and Messrs. George Kent Ltd.

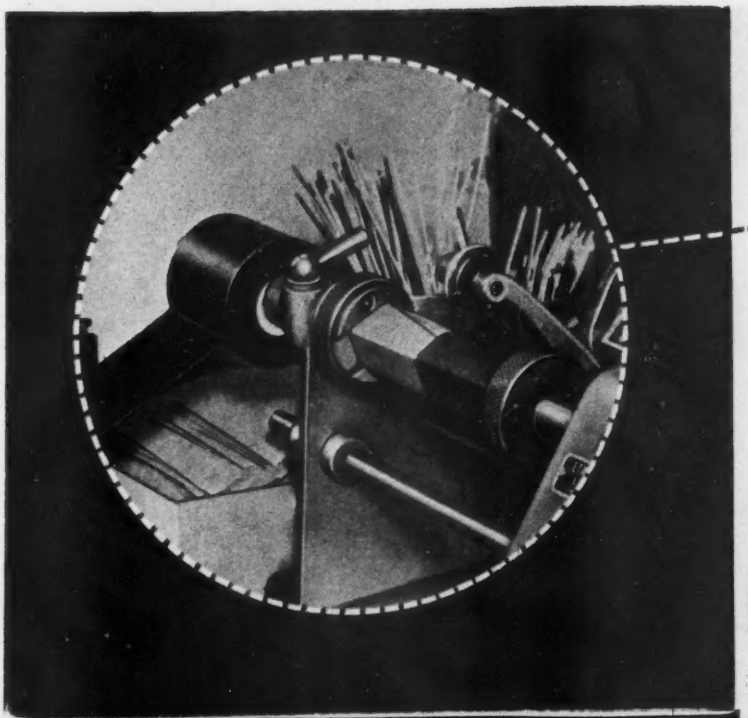


Power Stations

THE ZENITH ELECTRIC COMPANY LIMITED

ZENITH WORKS • VILLIERS ROAD • WILLESDEN GREEN • LONDON N.W.2

Telephone: WILLESDEN 6581/5 Telegrams: "VOLTAOHM, NORPHONE, LONDON"



COIL WINDING

WITH

PJL

POLYTHENE TAPE

P.J.L. Polythene electrical tape provides a reliable, waterproof, self-adhesive tape with outstanding electrical properties and superb conformability. The bonded rubber-resin adhesive is formulated to give good ageing properties and freedom from corrosive elements, while by specialised production methods dishing and coning are kept to a minimum. Proof against sunlight, acids, alkalis, oils and fungus, P.J.L. Polythene tape is available in two thicknesses, .005" in six British Standard Colours or .004" in black only.

The P.J.L. range of electrical tapes also includes Self-Bonding P.V.C., Plasticised P.V.C., Polyester Thermosetting, Polyester Silicone, Glass Fibre Tapes, etc. All are designed to meet *your* problems, and conform to Government and B.S.S. specifications.

Please write for full details or ask our technical representative to call.

P.J.L. Res-i-Glas (glass fibre, polyester resin bonded) replaces steel banding on armatures. Please ask for details.

**Illustration shows core coil winding with P.J.L. Polythene tape at the Romford factory of D. E. Cowling & Sons Ltd.*

PAYNES *Jiffytape* LIMITED

A Ministry of Aviation & Nat. Office approved firm (Reg. No. 29194)

1-6 Speedy Place, Cromer Street, London, W.C.1 TERminus 7146

ONE OF THE F. P. PAYNE & SONS LTD. GROUP OF COMPANIES

PJL

METWAY

Elements

for

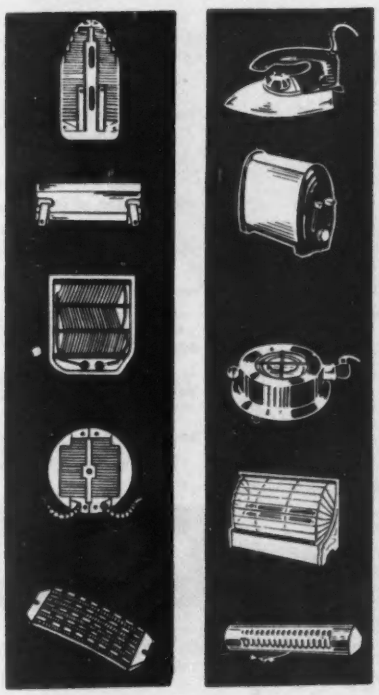
- **IRONS**
- **WASHBOILERS**
- **TOASTERS**
- **PERCOLATORS**
- **BOWL FIRES**
- **BOILING RINGS**
- **KETTLES**
- **FIRES**
- **REFRIGERATORS**

etc.

★ 2,000 different types in stock.

★ Everyone says
"If you want elements, one or a million—
ASK METWAY!"

Write for our invaluable Catalogue No. MYP/4.ET



Appliances

"RITZWAY"
AUTO IRON **64/3** + p.t.

"TOASTAWAY"
AUTO TOASTER **79/9** + p.t.

"DANDYWAY"
BOILING RING **22/6** + p.t.

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REFLECTOR FIRE **38/6** + p.t.

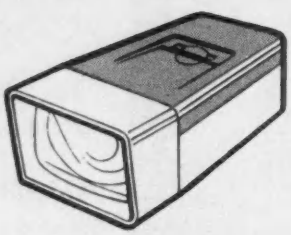
"GLOWAWAY"
INFRA-RED FIRE **85/-** + p.t.

For full details of all our appliances, ask for Catalogue No. DAR/40ET

METWAY • KEMP TOWN • BRIGHTON 7

TAKE A GOOD VIEW!

18 mouldings-just one fixing screw



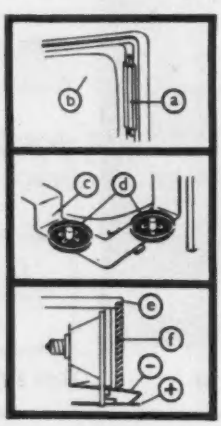
Keen on photography? Next time you pass a photographic shop look at this brilliant, new, colour-viewer by Johnsons of Hendon Ltd. As a photographer you will appreciate its undoubted efficiency and the advantages of its variable magnification. The ingenious arrangement for holding the slide in position also closes the electrical circuit to provide illumination without resort to finger-pressure or a switch.

As a plastics engineer or user, you will be impressed by the superlative finish of the two-colour injection mouldings, the single fixing screw and the unique way the lenses have been secured. We co-operated in the design, made the tools, produced the mouldings and handled assembly and packaging. Our associate company the British Optical Lens Co. designed and produced the glass lens system.

The wedge (a) holds the lens (b) in position securely, yet allows for minor alignment adjustments.

Electrical contact strips (c) are attached by metal fasteners (d) which clip over plastic pins.

The overlapping ledge (e) holds the slide (f) in position and simultaneously completes the electric circuit.

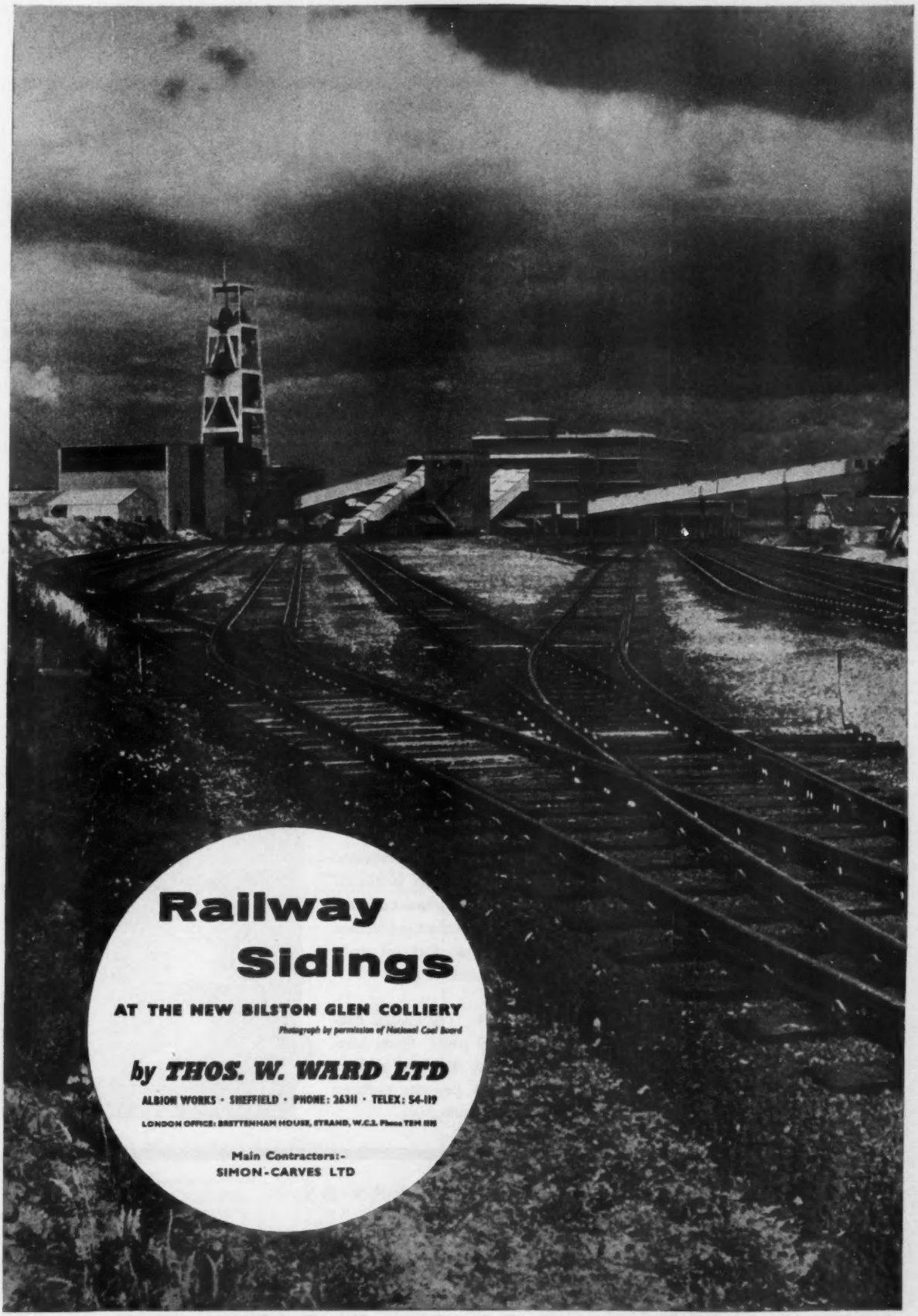


E. Elliott Limited

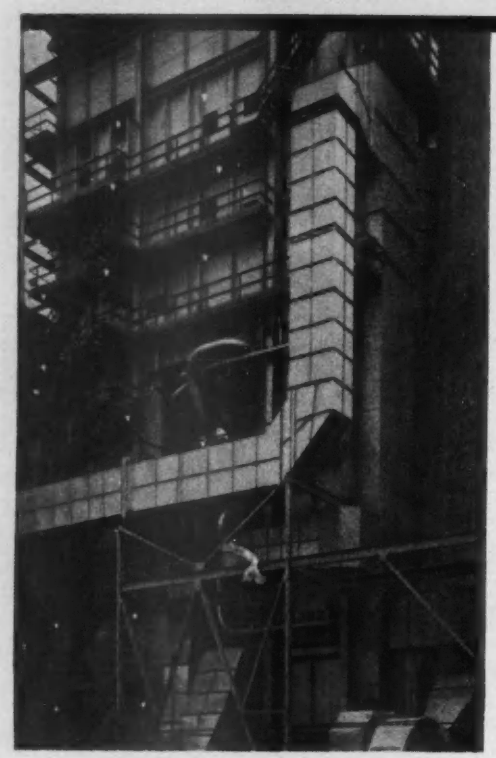
THE PLASTIC MOULDERS WITH THE ENGINEERING BACKGROUND

315 SUMMER LANE, BIRMINGHAM, 19

Telephone: ASTon Cross 1156/7/8/9


Railway
Sidings
AT THE NEW BILSTON GLEN COLLIERY
Photograph by permission of National Coal Board
by THOS. W. WARD LTD
ALBION WORKS · SHEFFIELD · PHONE: 26311 · TELEX: 54-119
LONDON OFFICE: BRETTENHAM HOUSE, STRAND, W.C.2. Phone TEM 1111
Main Contractors:-
SIMON-CARVES LTD

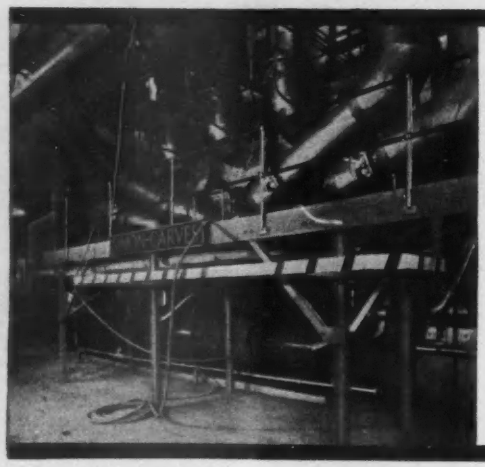
"Remarkable" SAID THE MINISTER



So said Mr. Richard Wood, the Minister of Power, at the inauguration of Britain's first once-through supercritical forced-circulation boiler. Designed and built by Simon-Carves at the Margam works of the Steel Company of Wales, it marks a major advance in large-scale steam generating practice.

The steam conditions of 3300 p.s.i. and 1060°F are the highest yet commercially used in Great Britain. The associated back-pressure turbo-alternator gives an output of 9500 KW (approximately 30% increased on the installed capacity of the existing generation plant). Process steam is exhausted at 650 p.s.i.g. and reheated to 820°F to serve the new turbo-blowers and the existing system.

Whether generating steam at pressures above or below the critical pressure, the O T boiler has many advantages over conventional natural and assisted circulation boilers. These are explained in the brochure 'OT Forced-Circulation Boilers by Simon-Carves Ltd'.



left. The operating front of the boiler is housed in the turbine building. Fuel can be blast furnace gas or fuel oil or a mixture of both.

right. The central control panel. From here, both the boiler and the high pressure turbines are controlled.

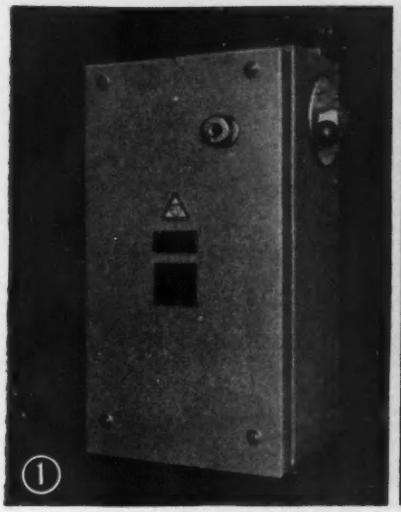
O T FORCED-CIRCULATION BOILERS BY

Simon-Carves Ltd

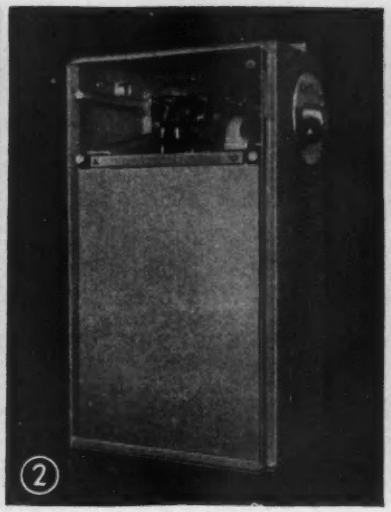
MEMBER COMPANY SIMON ENGINEERING LTD

CHEADLE HEATH, STOCKPORT · *AND AT CALCUTTA · JOHANNESBURG · SYDNEY · TORONTO*

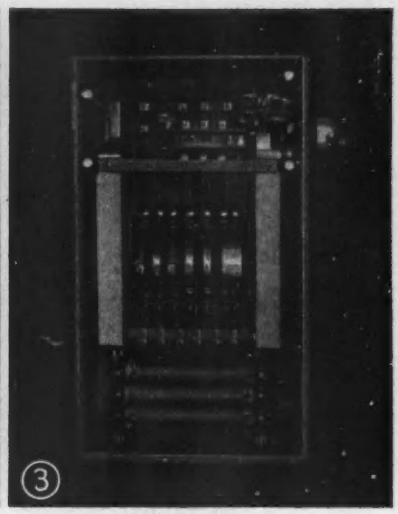
SC 252/PS



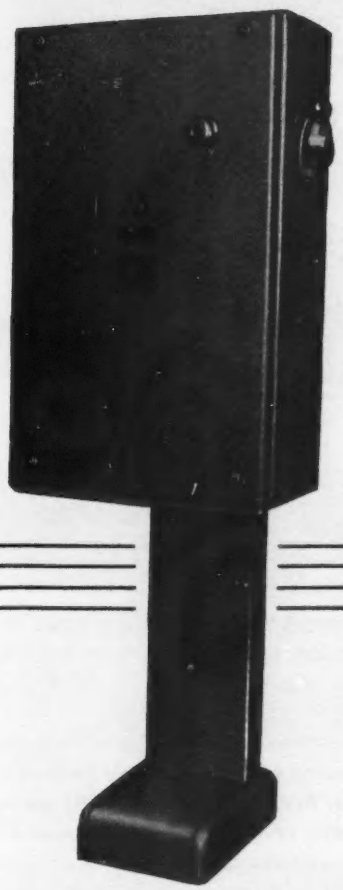
1. EAC oil-immersed stator-rotor starter.



2. With cover removed and tank in place.



3. Cover and tank removed



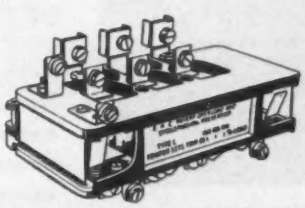
EAC oil-immersed autotransformer starter, floor fixing pattern.

New advances in

OIL IMMERSED CONTROL GEAR

An entirely new range of oil-immersed control equipment for A.C. Motors. It covers star-delta, stator-rotor and auto-transformer types and up-to-the-minute special features include a compact streamlined damp and dust-protecting enclosure with simple coin-slot fastening. The tank which is contained within the main enclosure is readily lowered and an isolating switch can be fitted. There are wall and floor-fixing patterns, the design incorporating several noteworthy electrical and mechanical advances. Leaflets 37, 38 and 39 provide full details. All types, of course, embody

the famous EAC



OVERLOAD AND SINGLE-PHASING PREVENTER UNIT

EAC are the ORIGINAL Single-phasing Preventer People

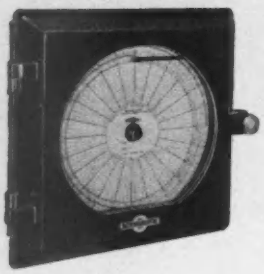
THE ELECTRICAL APPARATUS COMPANY LTD EAC ST. ALBANS

RADIOVISOR
EST. 1927

* P.E control

*

Photo-electric control helps *you* speed production, increase efficiency, cut costs.



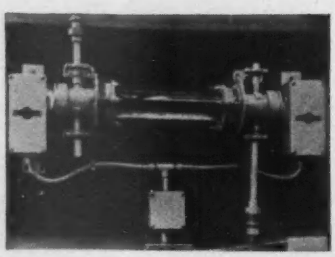
Event Recorder
A permanent record of 'ON' 'OFF' time associated with any process or operation. Idle machine time, duration, over-load periods, etc, are recorded on a 24-hour circular chart revolving at 1" per hour.

EVENT RECORDER

LEVEL CONTROL

TURBIDITY CONTROL

Electronic Level Control
Radiovisor manufacture many different types of electronic level control so that from their range a unit will be found suitable for any material or liquid.



Automatic Turbidity Control
For keeping a constant check on the clarity or turbidity of liquids in mineral water factories, breweries, chemical process plants and kindred industries.

RADIOVISOR P.E control

MAKERS OF THE MOST COMPREHENSIVE RANGE OF PHOTO-ELECTRIC CONTROLS IN THE WORLD

Radiovisor photo-electric and electronic controls include:

Flamestat Flame Failure Control • Smoke Detector Fire Alarm Sequence Control • Counting and Batching Unit • Invisible Ray Burglar Alarm • Turbidity Equipment • Hopper and Bunker level Control • Print Registration • Photo-electric Safety Guard • Factory Lighting Control • Automatic Radiation Pyrostat • Automatic Door Opening • Industrial Smoke Density Indicator and Alarm Resistance Welding Control

RADIOVISOR PARENT LIMITED, Stanhope Works, High Path, London, S.W.19
Telephone: CHErrywood 3351 Telegrams: Radivisor, London, S.W.19

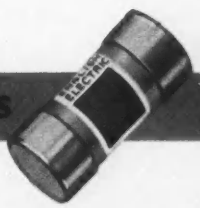
'ENGLISH ELECTRIC'

H.R.C. CARTRIDGE FUSE-LINKS

INDUSTRY

ELECTRICITY SUPPLY

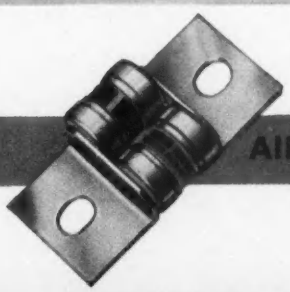
DOMESTIC CONSUMERS' UNITS



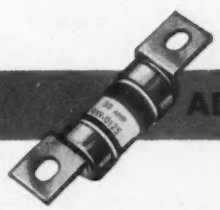
PLUGS

TRACTION

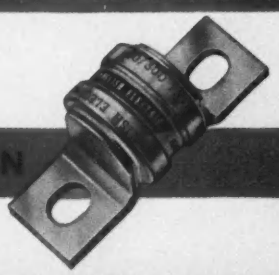
RAILWAY SIGNALLING



AIRCRAFT



ADMIRALTY & INTERSERVICE



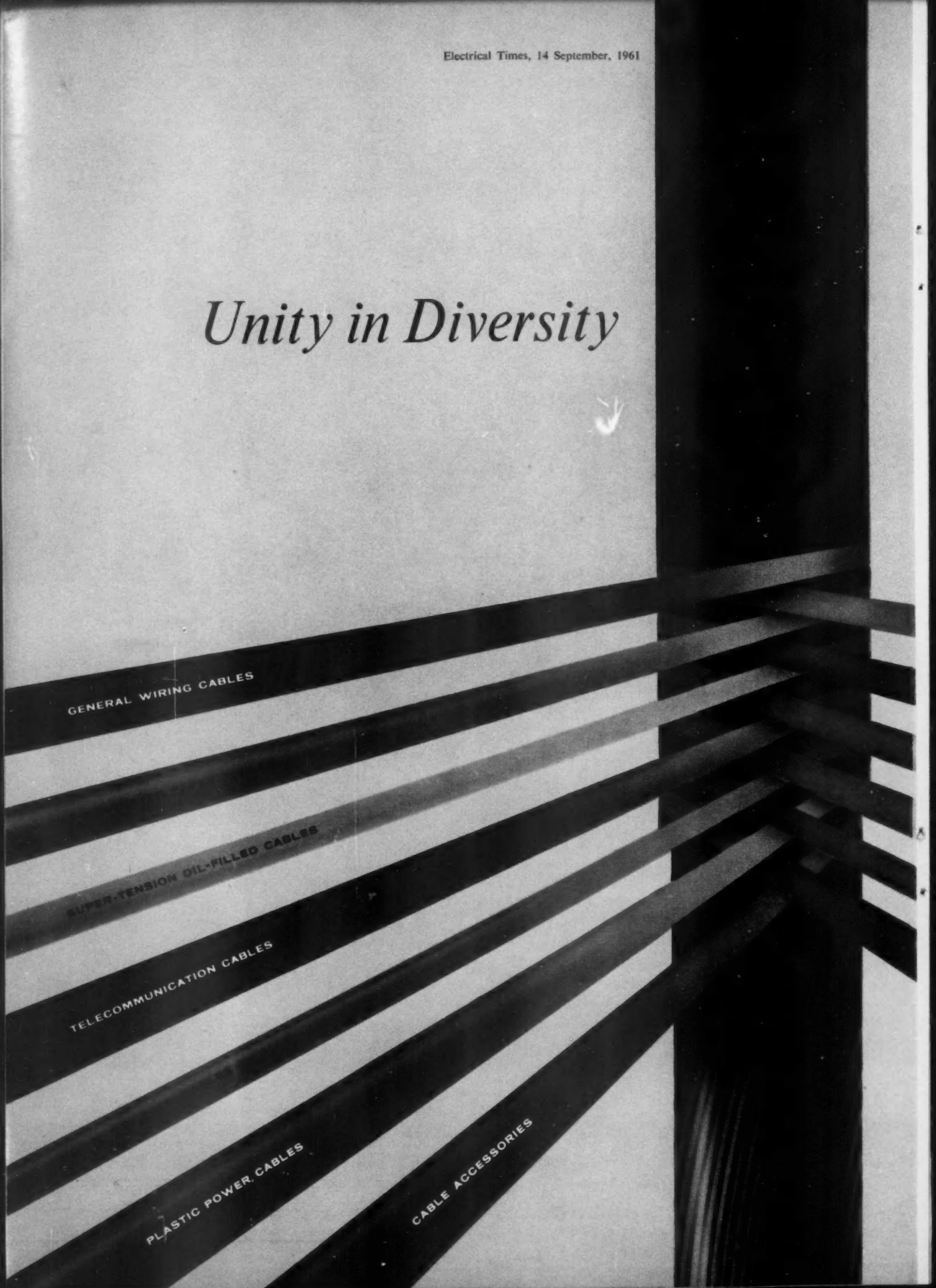
SEMI-CONDUCTOR RECTIFIER PROTECTION

THE STANDARD OF QUALITY AND PERFORMANCE THE WORLD OVER

FUSEGEAR DIVISION, EAST LANCASHIRE ROAD, LIVERPOOL, 10
The English Electric Company Limited, English Electric House, Strand, London, W.C.2.

FG 64

Unity in Diversity



PIRELLI-GENERAL

A compact, self-contained organisation, long established at Southampton and Eastleigh for the manufacture, development and sales of wires and cables for the electrical industry.

Pirelli-General offers the most comprehensive cable service to industry today. Continuing research and development maintains Pirelli-General's technological leadership, the results of which are available to all.

Pirelli-General Wire and Cable Products

V.I.R. and P.V.C. Insulated cables for general purposes — Impregnated Paper Cables and Accessories · Super-Tension Cables and Accessories · Telecommunication Cables for sound and picture transmission, audio and radio frequencies · Plastic Power Cables and Accessories · Shipwiring Cables, including butyl rubber insulation · Mining Cables, including trailing, shaft and roadway, signalling and telephone cables · Cables for Railway Electrification · Conductor wires, covered with enamel, textile and glass fibre, etc., insulants · Self-Supporting Aerial Pilot cables

PIRELLI-GENERAL CABLE WORKS LIMITED SOUTHAMPTON AND EASTLEIGH

best way to buy

These cables are obtainable from G.E.C. Installation Equipment Group or direct from Pirelli-General Cable Works Ltd.

CHECK WITH A METROHM
THE ONE-HANDED INSULATION AND CONTINUITY TESTER

Routine tests and inspection work on all electrical circuits is immensely simplified with Everett Edgcumbe's Metrohm. This is a light, portable insulation and continuity tester giving the operator a steady direct reading of insulation up to 50 megohms, and at the turn of a switch, continuity on a scale calibrated to 100 ohms. The two test leads are fitted with crocodile prod clips for easy access to fuse boxes, switchgear, etc.

Four models are in production: metalclad shown here; intrinsically safe for use in methane and pentane atmospheres; industrial, without the metal case; mains operated bench model. Technical Sheet 242A describes and illustrates the full range of Metrohms.

Please send for Sheet 242Ab

Other Products include: Timers · Synclock Motors · Metrac · Metrans · Battery Charge Indicators · Recorders

EVERETT EDGCUMBE

EVERETT EDGCUMBE & COMPANY LTD.
COLINDEEP LANE · LONDON · N.W.9.

Telephone: COLINDALE 6045.
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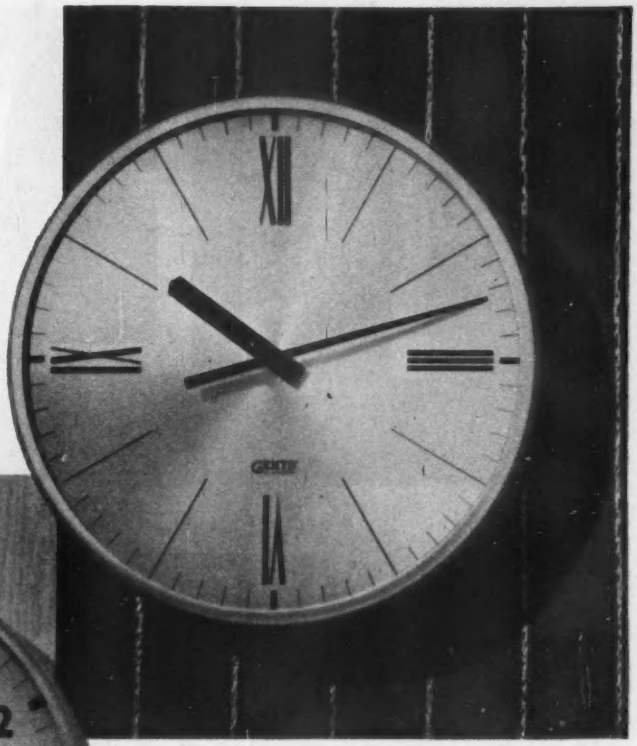
PAM 694



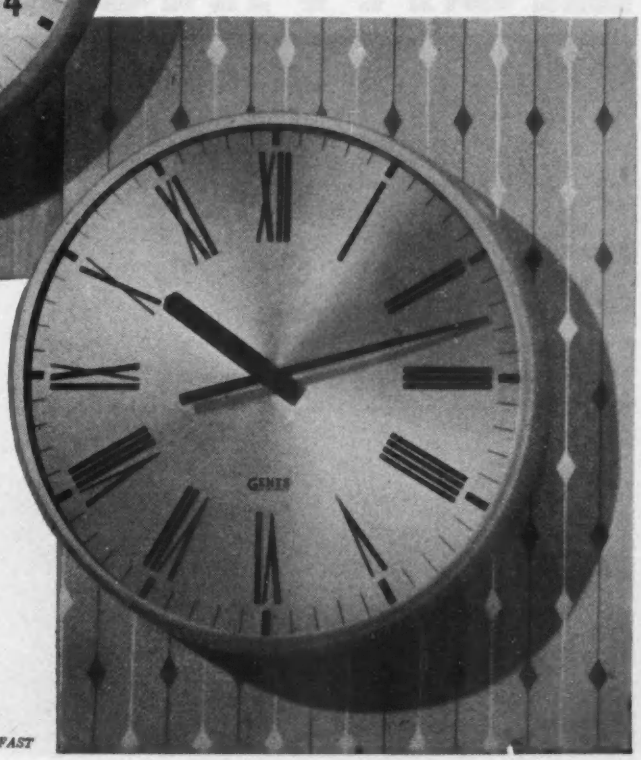
Maximum legibility and good taste are combined in the Gents wall clocks shown here.

Styled by a leading industrial designer they provide a choice of standard models which fit happily into present-day surroundings and décor.

These and others in the extensive Gents range have been selected by the Council of Industrial Design for inclusion in Design Index.

All are available for operating either on A.C. Mains or as part of a Master Clock System.

In every way...Right!



Most models are now available from stock

Full details and literature on request

GENTS
OF LEICESTER

ELECTRIC CLOCKS

GENT & COMPANY LIMITED,
Faraday Works, Leicester. Telephone: 36151

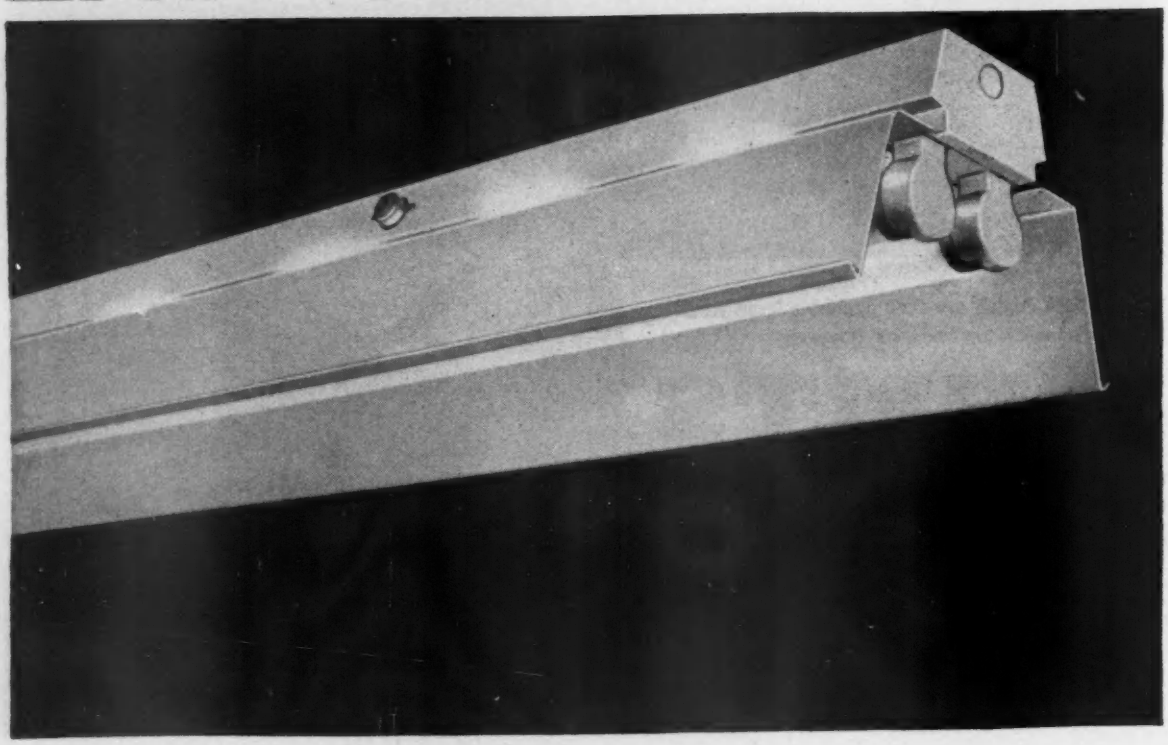
London Office & Showroom:
47, Victoria Street, S.W.1. Telephone: ABBey 6888

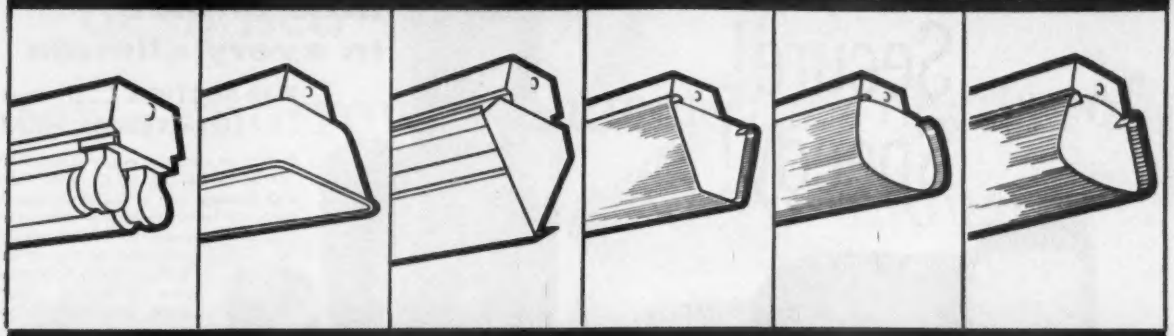
Also at: BIRMINGHAM. BRISTOL. EDINBURGH. GLASGOW. NEWCASTLE. BELFAST

NEW

DURHAM RANGE

LIGHTING FITTINGS





a complete and compact range

- Switchstart and quickstart throughout range
- Easy installation and maintenance
- Superbly engineered

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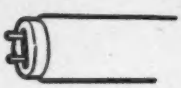
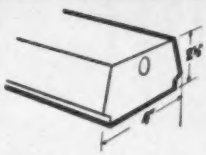
- Competitive price
- Quality materials and manufacture
- Wide range of quick-fix reflectors and diffusers

LIGHTING ADVISORY SERVICE
Ekco-Ensign operates a Lighting Advisory Service throughout Great Britain. Qualified Lighting Engineers will be pleased to call on you, discuss your particular problem and to prepare detailed lighting schemes. This service is entirely free and without obligation.

EASY ASSEMBLY AND MAINTENANCE

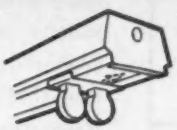


Tubes
For 8 ft., 5 ft. & 4 ft. single and twin.
Also 85w 8 ft. twin.

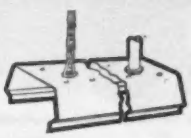


Spine
Identical strong shallow section for all tube sizes—single and twin.

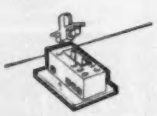
Packing
All fittings separately cartoned. Lampholder platforms ready-wired packed in spine.



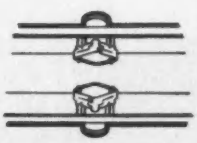
Lampholder Platform
Platform locked into position without tools. Lampholders cannot be reversed on twin fittings.



Installation
For chain, conduit or direct-on-ceiling. Knockout at centre and in endplates.

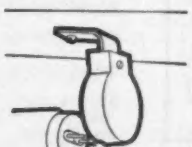


Fused Terminal Block
3-way block for fitting protection — easily replaceable B.S. cartridge fuse.

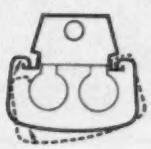


Starter Switches
Instantly accessible without dismantling fitting.

Reflectors & Cover Plates
Quickly and easily attached by a simple locking device.



Lampholders
White, plastic, sprung, bipin for positive operation.



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Positively attached to spine by simple swing-over action.

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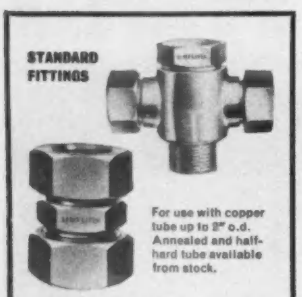

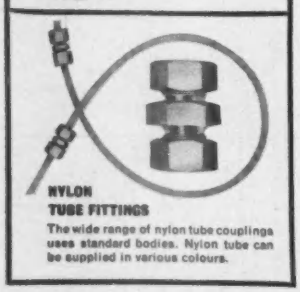
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Simplifix compression couplings are the easiest, fastest, most practical way to connect copper or nylon tube . . . designed to make perfect joints at the turn of a spanner without the pipe twisting. Simplifix couplings are made in a full range of standard sizes. Also, non-standard fittings can be quickly produced to your specification. Illustrated catalogue and technical advice gladly provided on request.

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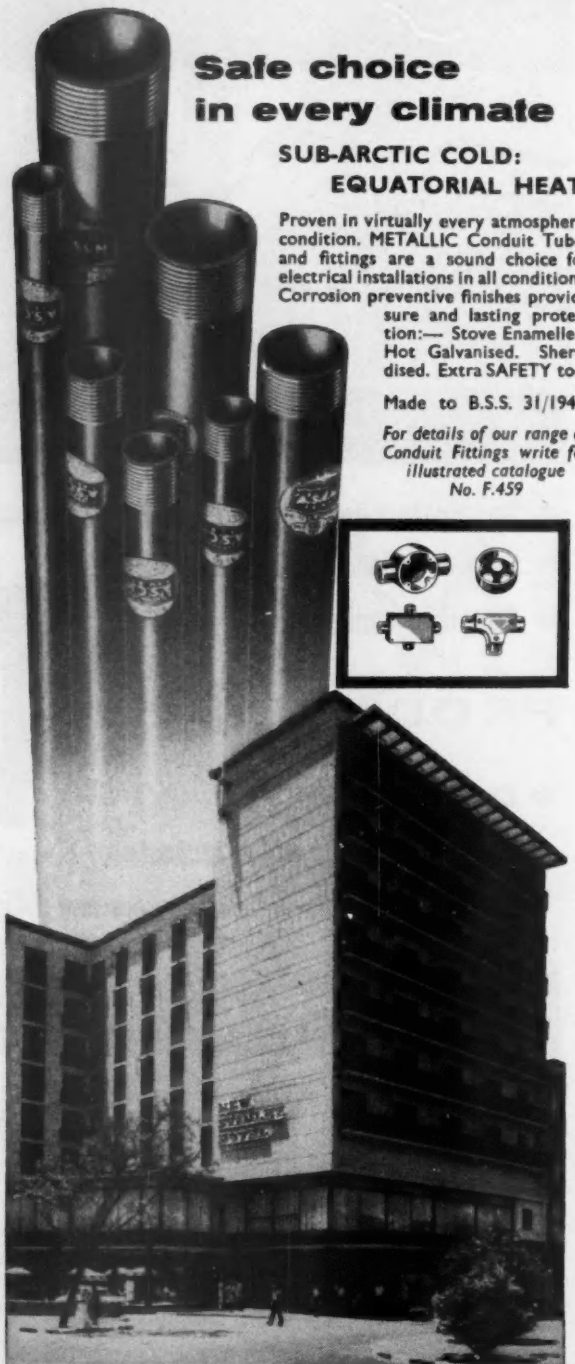

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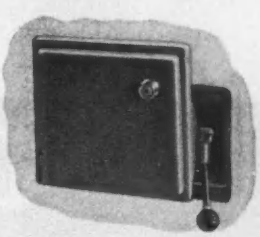

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Testing plays a larger part in the development of switchgear than of most plant. And it is not a matter of subjecting a circuit-breaker to a heavy overload to see whether it blows up. On the contrary, to the non-specialist observer a test is an almost ludicrous anti-climax. The build-up is impressive; long preparation, elaborate fire precautions, the switchgear itself as distant as the target in a rifle range and watched through armoured glass. A warning hooter clears the site. Then the test engineer presses a control switch . . . in complete silence absolutely nothing happens, and the test—another 'shot'—is over. But a battery of oscillographs has recorded on photographic film a complete history of everything of importance that happened inside the switch. This is one approach to . . .

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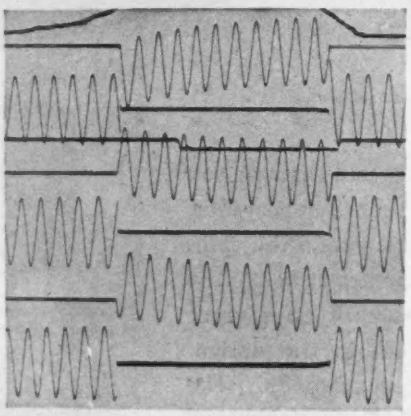

Any new design or improvement of an existing one involves many such tests of numerous detailed innovations. They are the means by which the designer checks his work as it proceeds. Ready access to test facilities is thus an essential of his work. We are fortunate in having at Chelmsford one of the most up-to-date (ASTA) testing stations in the country, and this has played a most important part in the evolution of all our switchgear. But there is another side to know-how which comes from sheer experience—and we have had 80 years of that.

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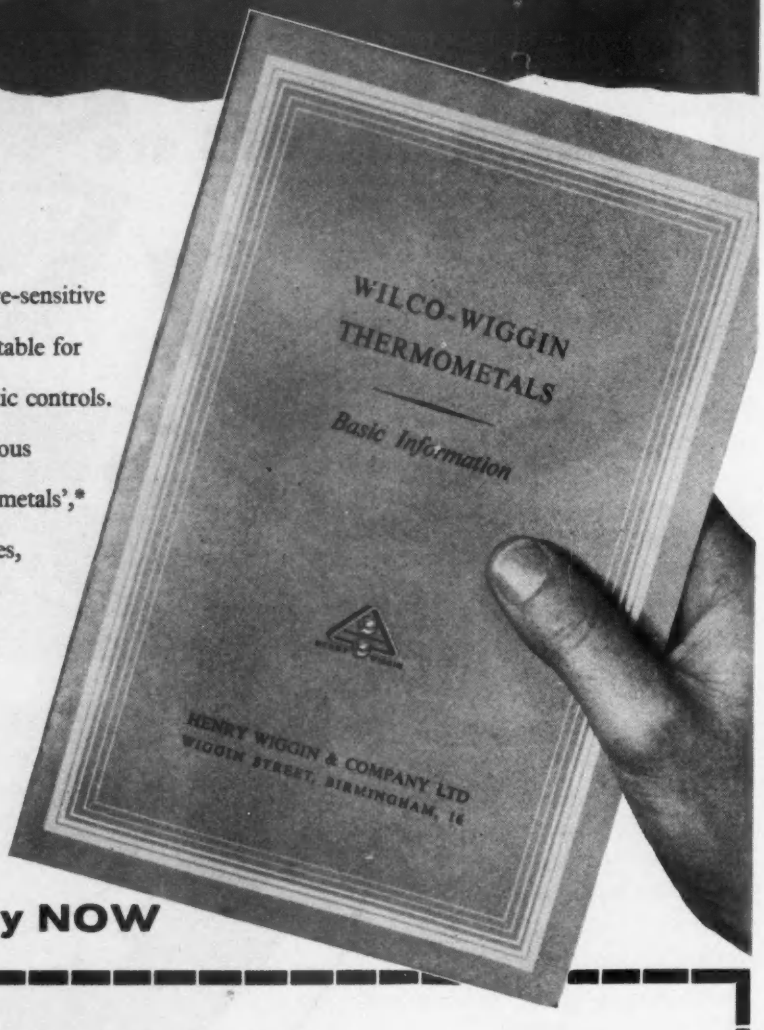

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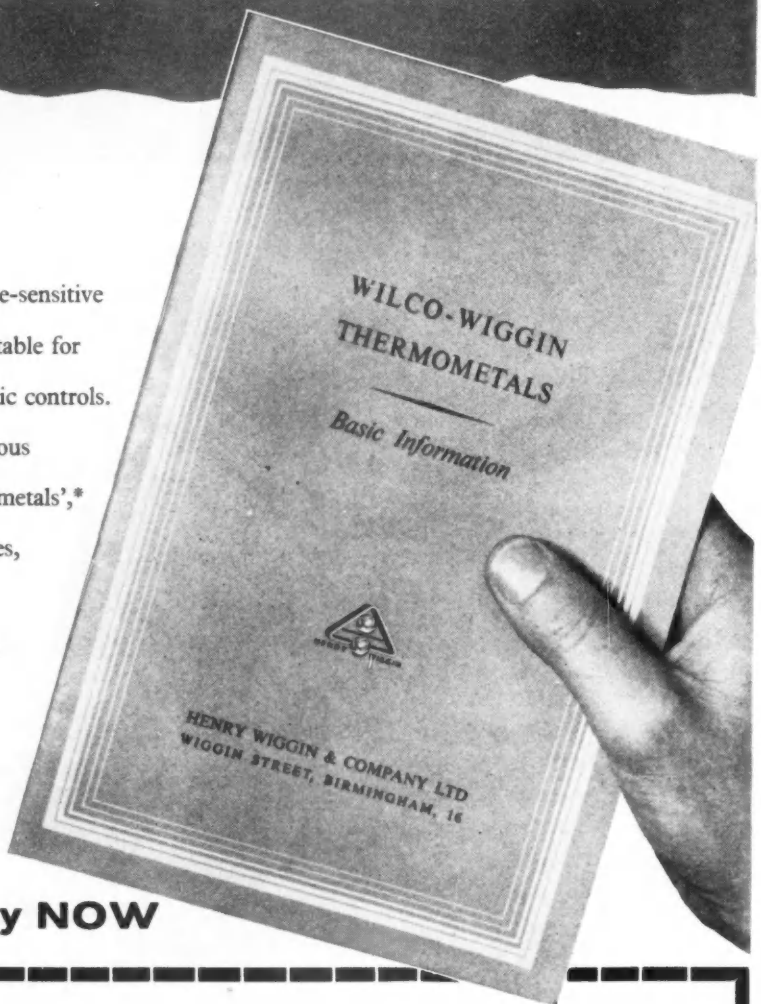

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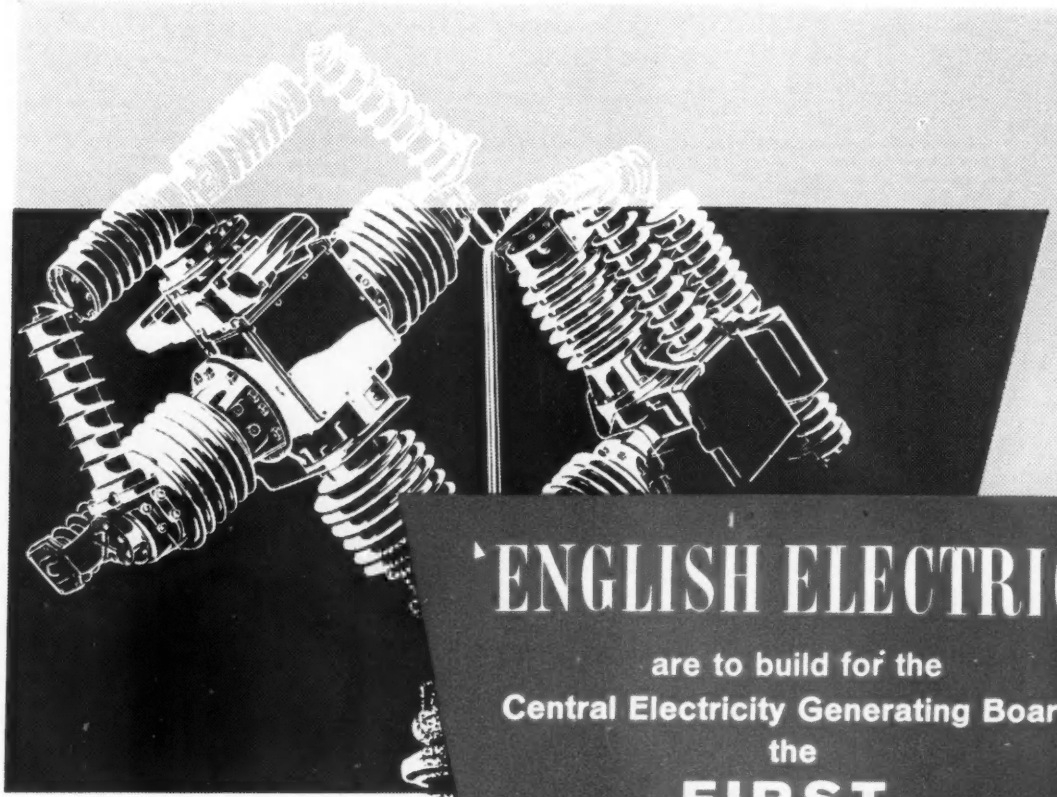

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installation of

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The switchgear will form a complete duplicate busbar switching station at West Burton Power Station and will include thirteen 400 kV 35,000 MVA air-blast circuit-breakers, power-operated isolators and associated apparatus. This is the highest-rated switchgear so far ordered.

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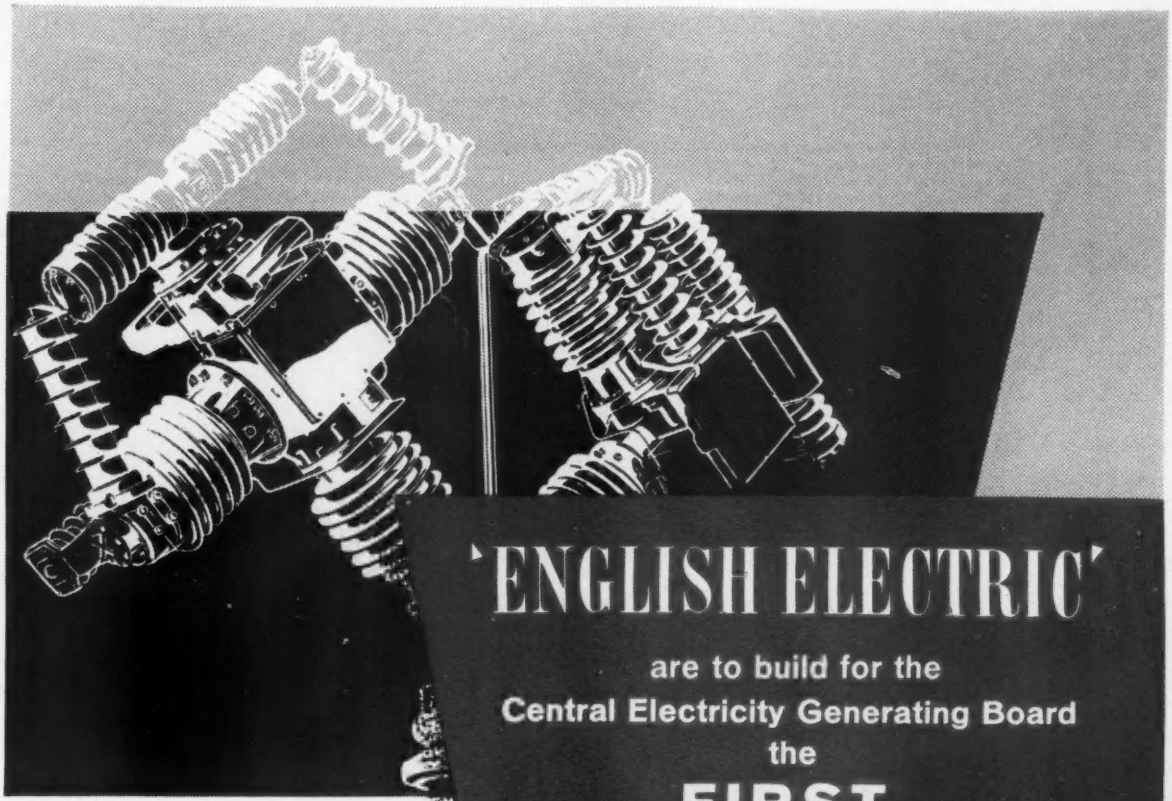

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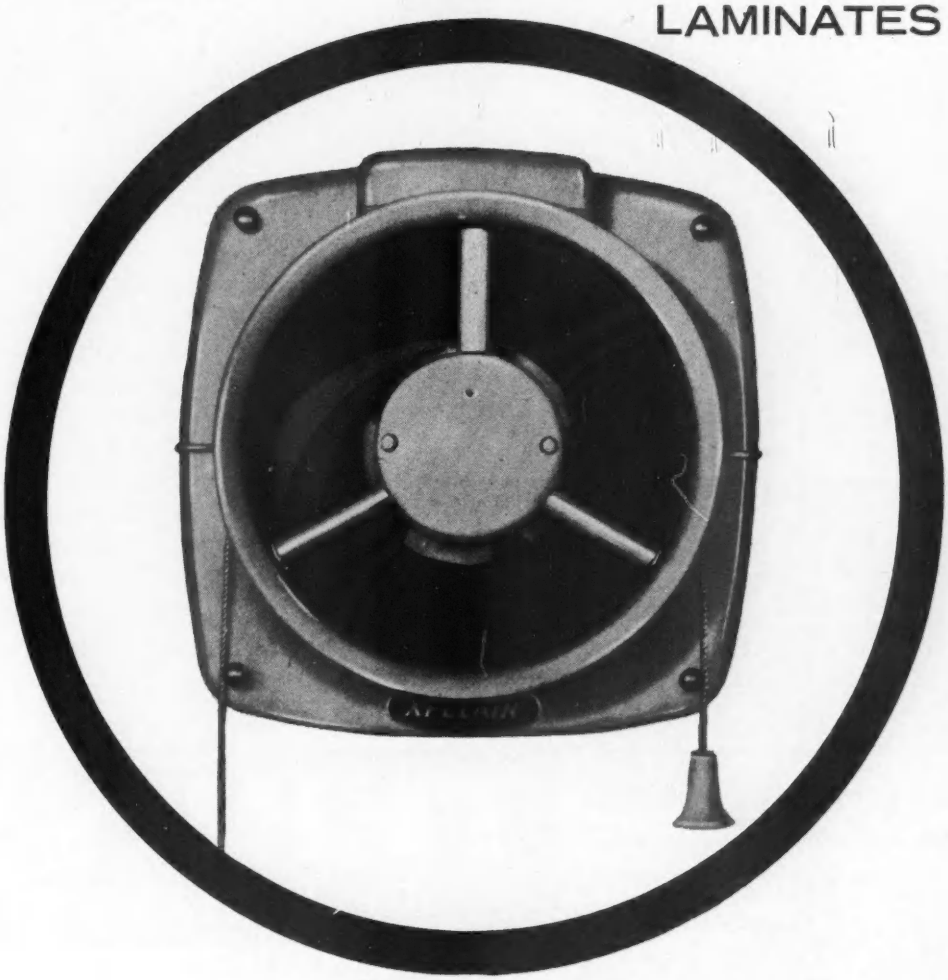

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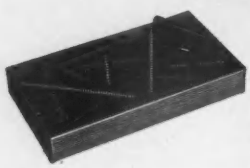
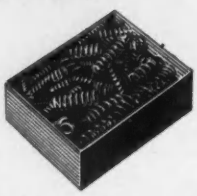
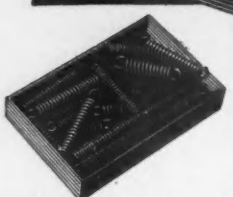


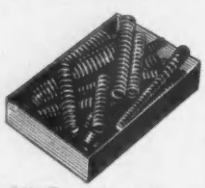
No. 1200. Three dozen Assorted Light Expansion Springs, suitable for carburettor control, etc. **15/-.**



No. 98A. Three dozen Assorted 1″ to 4″ long, $\frac{1}{4}$″ to $\frac{1}{2}$″ diam., 19G to 15G. **6/6.**



No. 753. Three dozen Assorted Light Expansion $\frac{1}{4}$″ to $\frac{1}{2}$″ diam., 2″ to 6″ long, 22 to 18 S.W.G. **12/-.**



No. 760. Three dozen Assorted Light Compression Springs. 1″ to 4″ long, 22 to 18 S.W.G., $\frac{1}{4}$″ to $\frac{1}{2}$″ diam. **7/6.**

No. 757. Extra Light Compression, 1 gross Assorted, $\frac{1}{4}$″ to $\frac{1}{2}$″ diam., $\frac{1}{2}$″ to 2$\frac{1}{2}$″ long, 27 to 19 S.W.G. **18/-.**

No. 758. Fine Expansion Springs. 1 gross Assorted $\frac{1}{4}$″ to $\frac{1}{2}$″ diam., $\frac{1}{4}$″ to 2″ long, 27 to 20 S.W.G. **18/-.**

That spring you want . . . in a hurry . . . *where* is it? Pick *what* you want *when* you want it from TERRY'S BOXES OF ASSORTED SPRINGS—our fine range of small boxed assortments of experimental springs. We can show you only a few from the range here. Send a postcard for our full list—and if ever you're stuck with a spring problem send it along to our Research Department —they'll gladly help you out.

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HT31

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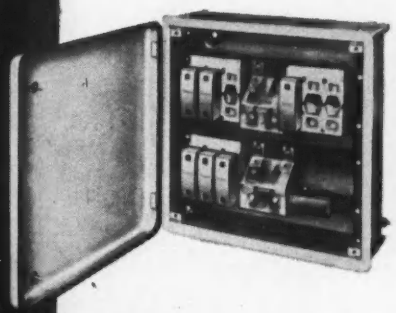

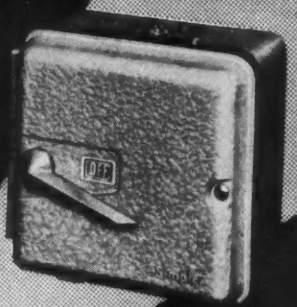

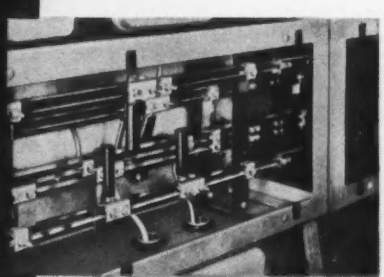

Front operated switchfuses; "dead-front" distribution fuseboards and remarkably easy wiring and maintenance facilities are embodied in this leading and challenging switchgear design.

Proved on test and in use, the Simplex Star range is styled in the modern manner and is selling at competitive prices.

Simplex Star switchfuses 15, 30, 60 amp. 500 volt.
Busbar chambers 200, 400, 600, 800 amp. 600 volt.
Distribution fuseboards 15, 30, 60 amp. 500 volt.

Simplex

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SIMPLEX ELECTRIC COMPANY LIMITED · CREDA WORKS · BLYTHE BRIDGE · STOKE-ON-TRENT · STAFFS
Branches throughout Great Britain and Agents throughout the World

Complementary Simplex Regent range. Robust, stylish switches, switchfuses, changeover switches 15, 30, 60, 100 amp. 500/600 volt. Busbar chambers 350, 550, 800 amp. 600 volt. Distribution fuseboards 15, 30, 60 amp. 500 volt.

Complementary Simplex Monarch range. Heavy duty fuse switches. Suitable for all lighting, heating and power loads without de-rating. 150, 300 amp. 500 volt. S.4.

with paper, cotton, glass and enamel.

In fact we have a reputation that is second to none for covered **COPPER WIRE** and **STRIP.**

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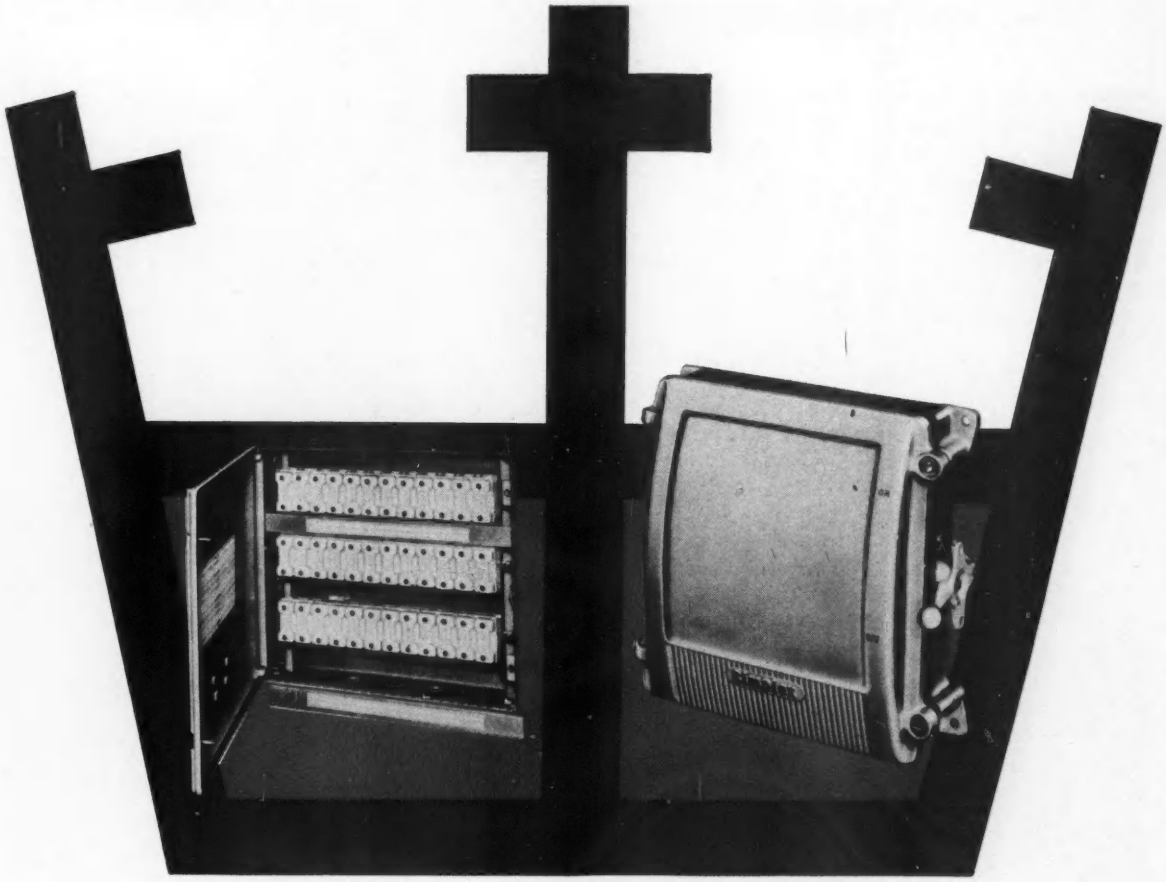

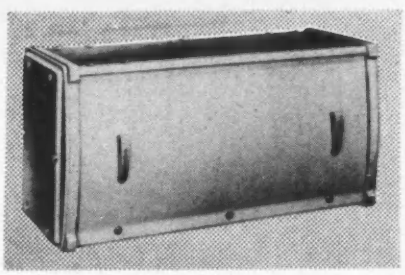

SIMPLEX REGENT SWITCHGEAR PART OF THE COMPREHENSIVE MEDIUM VOLTAGE SIMPLEX RANGE OF SWITCHGEAR

The sturdy, stylish Regent range of switches, switchfuses, and changeover switches are conventionally constructed to meet a very wide range of requirements. The casings are weatherproof and dust protected as defined in BS 861 and 2510. All units are HRC or rewireable — fuses completely interchangeable.
Sealing chambers and glands for Regent switchfuses are made for any type and size of normally used cable, either straight or reverse entry without drilling.
The entire Simplex Regent range is suitable for lighting, heating and power loads without de-rating.
Switches, switchfuses, changeover switches 15, 30, 60 and 100 amp. 500 volt.
Busbar chambers 350, 550, 800 amp. 600 volt.
Distribution fuseboards 15, 30 amp. 500 volt.

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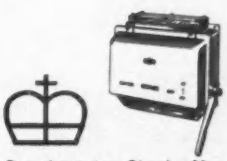
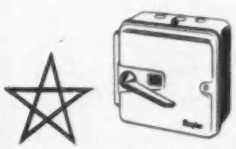
S.E.



Complementary Simplex Monarch range. Heavy duty fuse switches, suitable for all lighting, heating and power loads without de-rating. 150, 300 amp. 500 volt.



Complementary Simplex Star range. Economically priced, front operated switchfuses in 15, 30, 60 amp. 500 volt. Busbar chambers 200, 400, 600 and 800 amp. 600 volt. Distribution fuseboards 15, 30, 60 amp. 500 volt.

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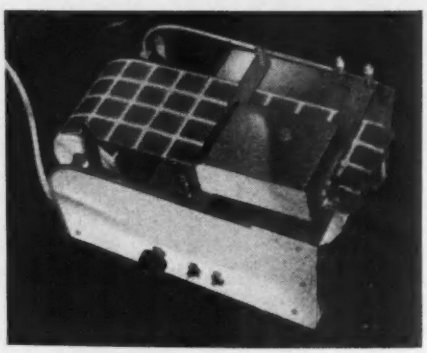

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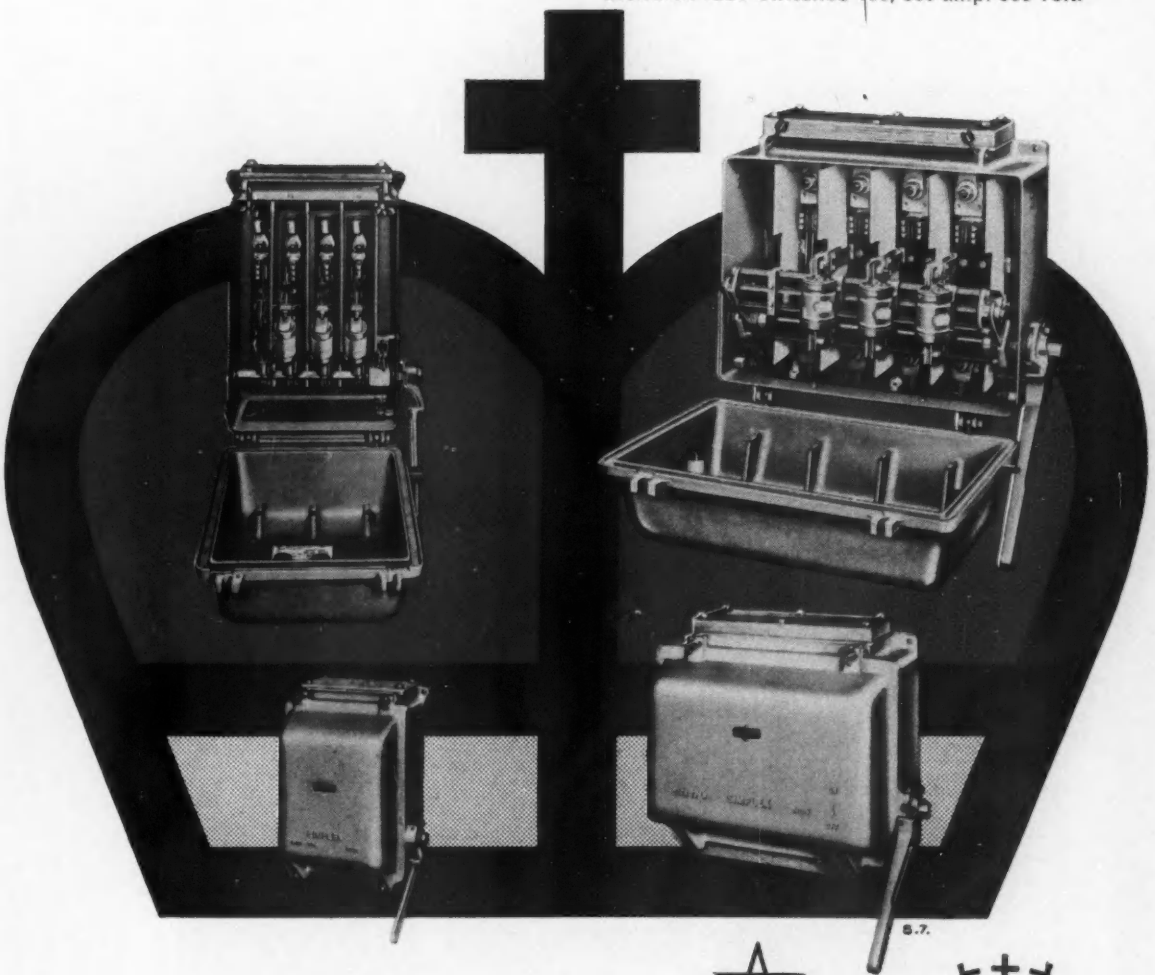
SIMPLEX MONARCH SWITCHGEAR- THE HEAVY DUTY RANGE IN THE SIMPLEX RANGE OF SWITCHGEAR

The robust, all-cast Monarch range of switches and fuse switches is primarily designed for heavy duty industrial work.

The casing is of weatherproof cast iron construction. The operating handle is interlocked with the cover. Provision for locking the cover or handle is also provided as standard, and handles can be supplied arranged for Castell interlocks.

Adaptor troughs are available for mounting on trunking and busbar chambers, and sealing chambers and glands for Monarch units are made to fit any type and size of normally used cable, either straight or reverse entry without drilling.

Monarch fuse switches 150, 300 amp. 500 volt.



S.7.

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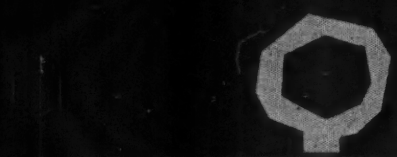
Complementary Simplex Star range. Economically priced, front operated switchfuses in 15, 30, 60 amp. 500 volt. Busbar chambers 200, 400, 600 and 800 amp ratings. 600 volt. Distribution fuseboards 15, 30, 60 amp. 500 volt.

Complementary Simplex Regent range. Robust, stylish switchfuses, 15, 30, 60 and 100 amp. 500/600 volt. Busbar chambers 350, 550, 800 amp. 600 volt. Distribution fuseboards 15, 30 amp. 500 volt.

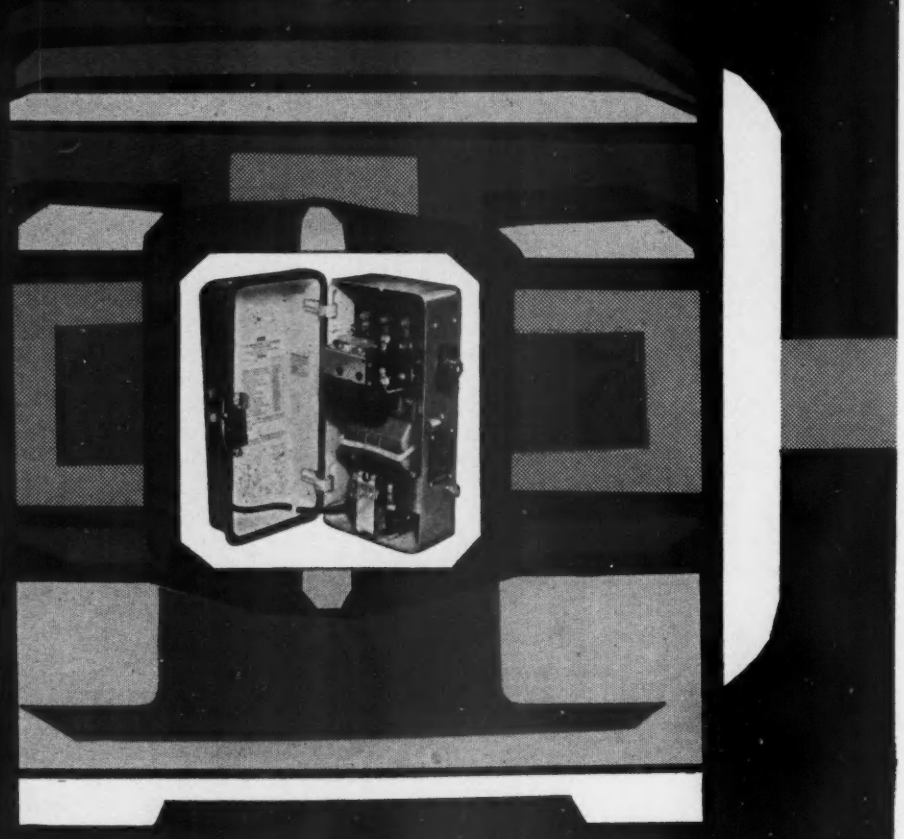
G.E.C.

MOTORS AND STARTERS— DELIVERY FROM STOCK



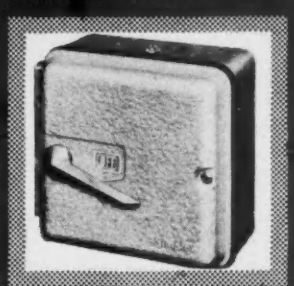
. . . a complete range of standard motors and starters

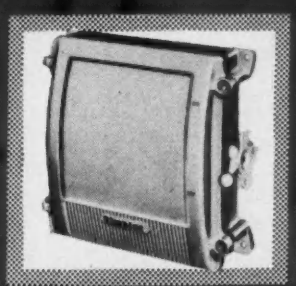
Including British Standard ventilated 'C' frame (to B.S. 2960) and totally enclosed 'B' (to B.S. 2083) and 'D' frame (to B.S. 2960 pt. 2) motors. Matching direct-to-line (non-reversing and reversing) and star-delta starters.

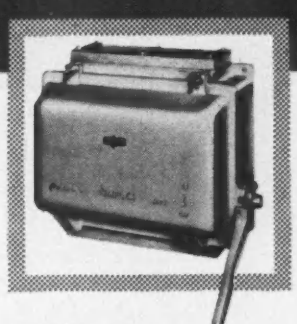


THE GENERAL ELECTRIC CO LTD OF ENGLAND · ENGINEERING GROUP · ROTATING PLANT DIVISION · BIRMINGHAM 6

Star..
Regent..
Monarch..







S.5

THE SIMPLEX RANGE COVERS EVERY *M. V.* SWITCHGEAR REQUIREMENT

Whether you judge by sheer value for money, by design or by unsurpassed technical reliability, Simplex make switchgear that leads the industry. The challenging up-to-date competitive Star range is cleanly styled in pressed steel cases ; the conventional Regent in cast-iron and composite metals ; and the heavy duty Monarch is clad in all cast cases. All three ranges comply with latest BS specifications, are complementary to the others, and can be built up as switchboards to meet any requirement. Technical data and the co-operation of a friendly advisory service is always available.

Simplex Star. Economically priced, front operated switchfuses in 15, 30, 60 amp. 500 volt. Busbar chambers 200, 400, 600 and 800 amp 600 volt. Distribution fuseboards 15, 30, 60 amp. 500 volt.

Simplex Regent. Robust, stylish switches, switchfuses, changeover switches 15, 30, 60 and 100 amp. 500/600 volt. Busbar chambers 350, 550, 800 amp. 600 volt. Distribution fuseboards 15, 30 amp. 500 volt.

Simplex Monarch. Heavy duty fuse switches, suitable for all lighting, heating and power loads without de-rating. 150, 300 amp. 500 volt.

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3 phase generator transformers
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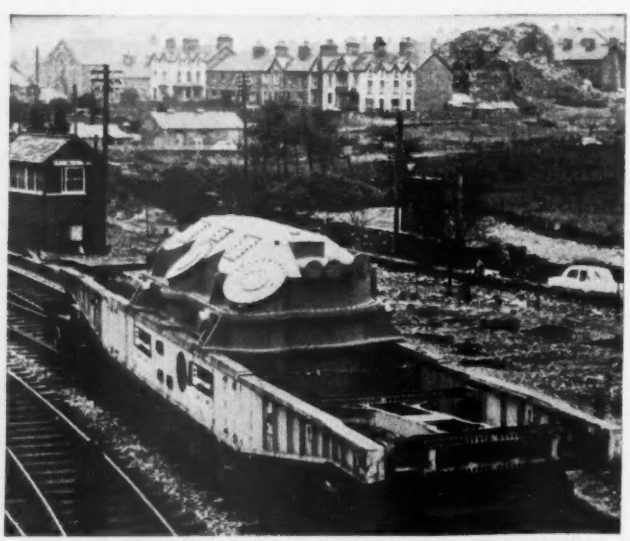

Transformer en route to site. Photograph by courtesy of British Railways, London Midland Region. Consulting Engineers, Kennedy & Donkin.

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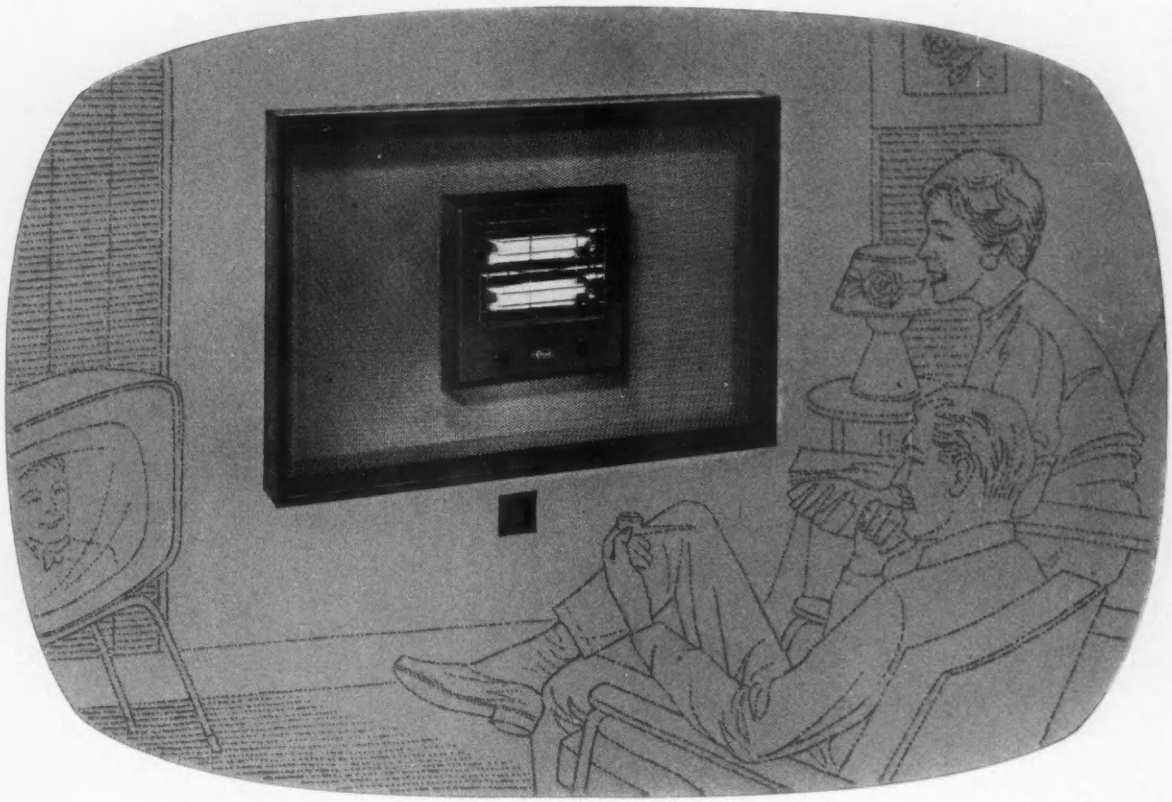

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'Carrontine' Finish

Overall size of wood surround	26″ high x 38¾″ wide x 5″ deep
Overall depth of surround, fire and guard	7 ins.
Loading (Bar Type Elements)	2 kW.
Weight of complete fire and guard	40 lbs.
Weight of fire	9½ lbs.

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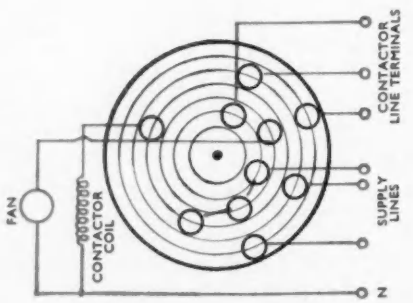

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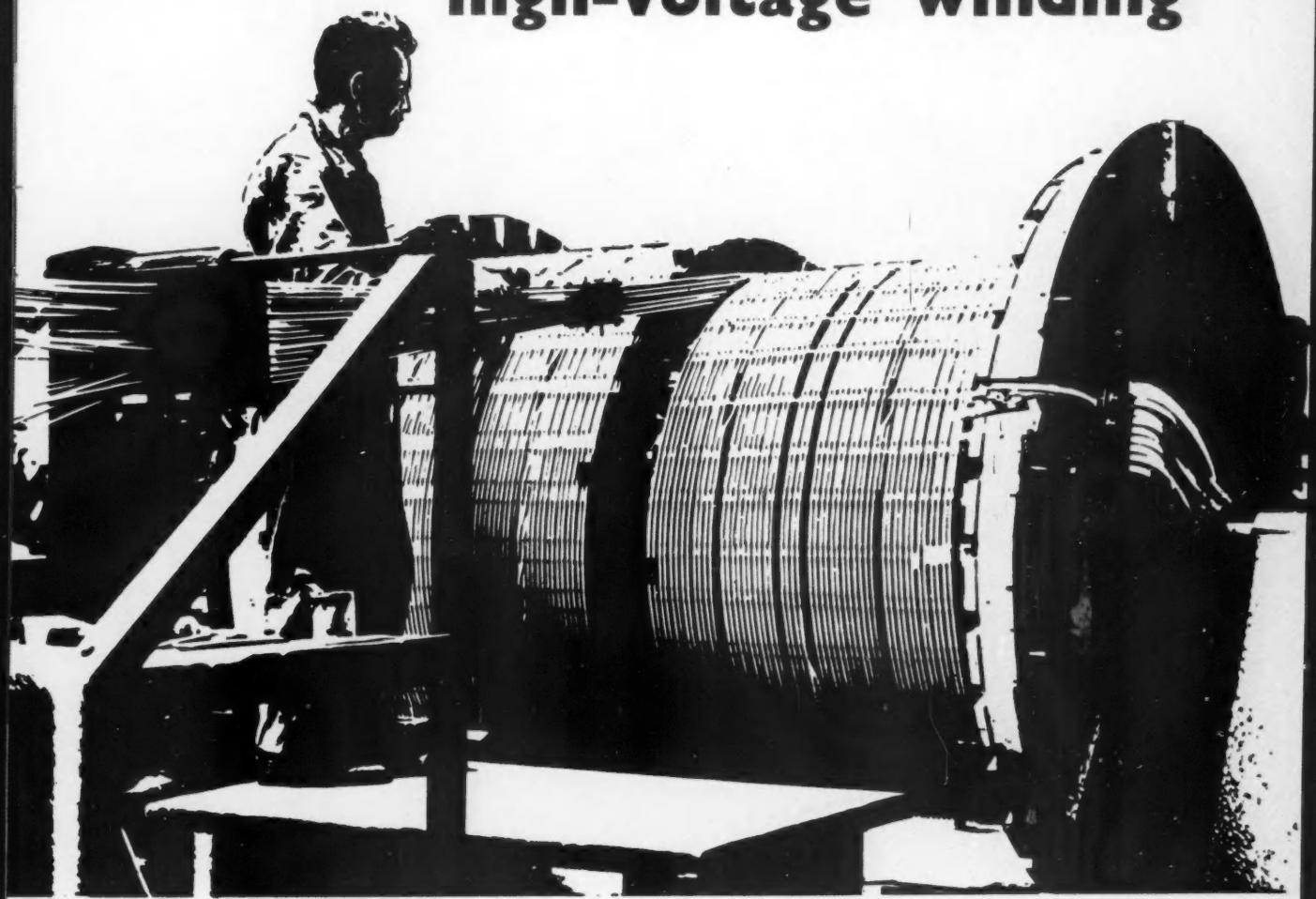

BICC Paper Insulated Strip on a Transformer at Bruce Peebles & Co. Ltd., Edinburgh

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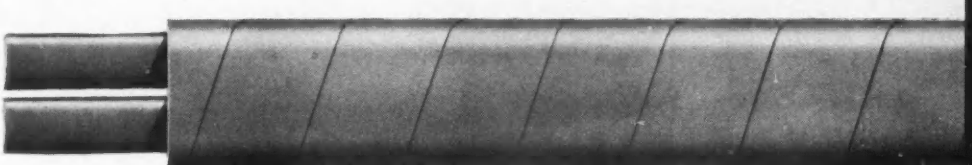
BICC PAPER COVERED STRIP



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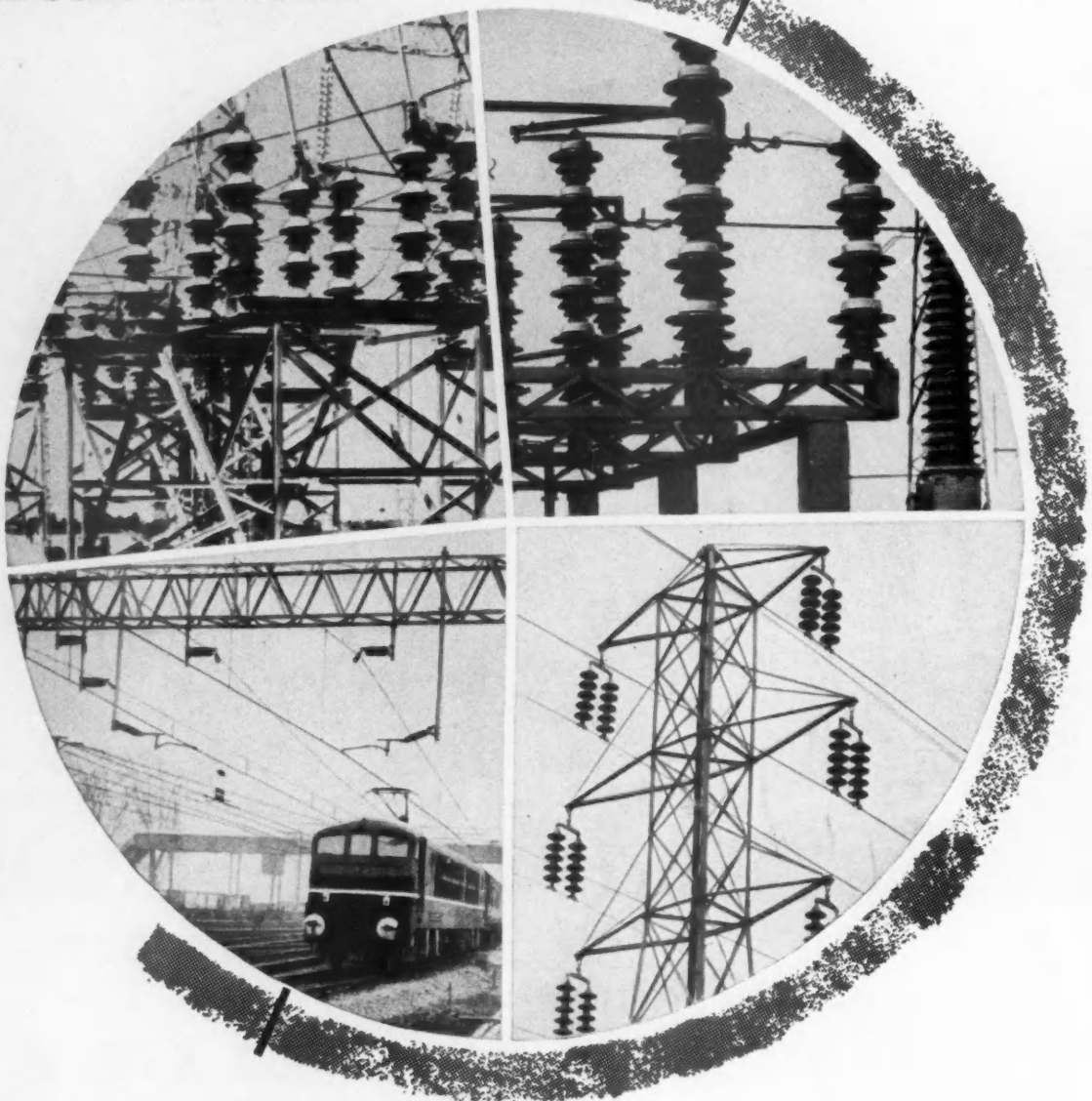

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TRUNKING
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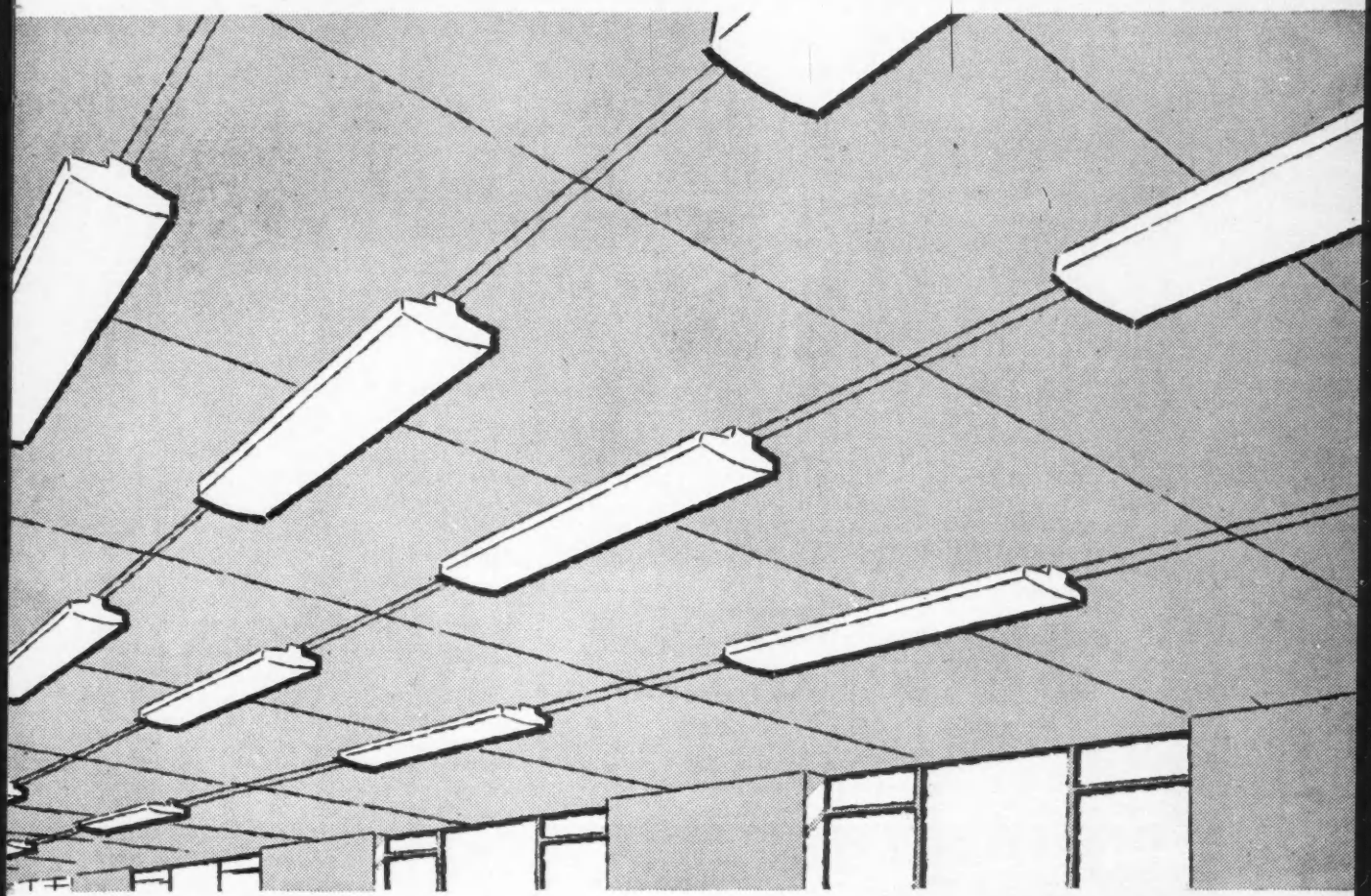

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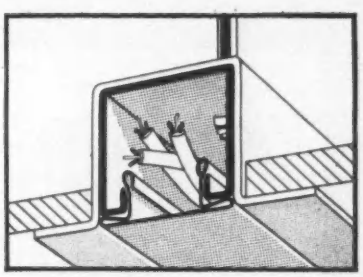

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considerably reduces range of sizes
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Any one size will not only accommodate itself to a variety of mounting plate thicknesses, but (designed for cable or control rod) will take these in a variety of sizes and be weather-, water- and dust-proof at a variety of angles to the cable or rod.

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THE NEW BLIND GROMMET

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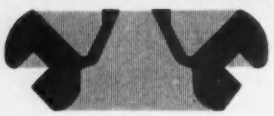

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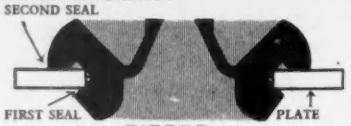
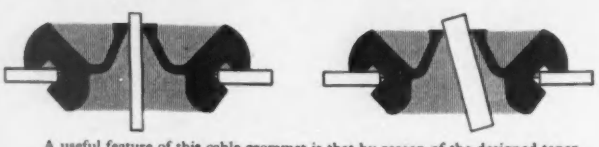


FITTED

Note how when sprung into position the grommet provides a perfect double seal by its own permanent pressures. The angled groove also creates a tight pressure hold on the metal plate.

In the cable grommet variety the same double pressure seal is created, allied to tight seal on various diameters of cable. This new grommet gives sound sealing at *all* vital points.



A useful feature of this cable grommet is that by reason of the designed taper of the cable entry and the flexibility of the web, a considerable angle of cable entry and a variety of cable size are possible. This avoids necessity for special grommets with angled bores.

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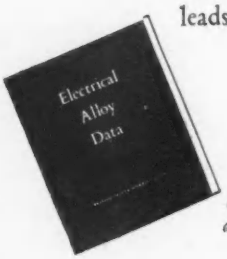

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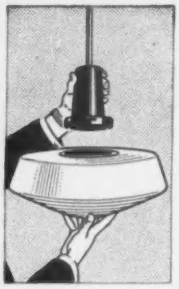

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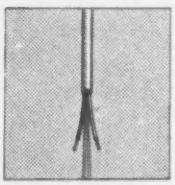

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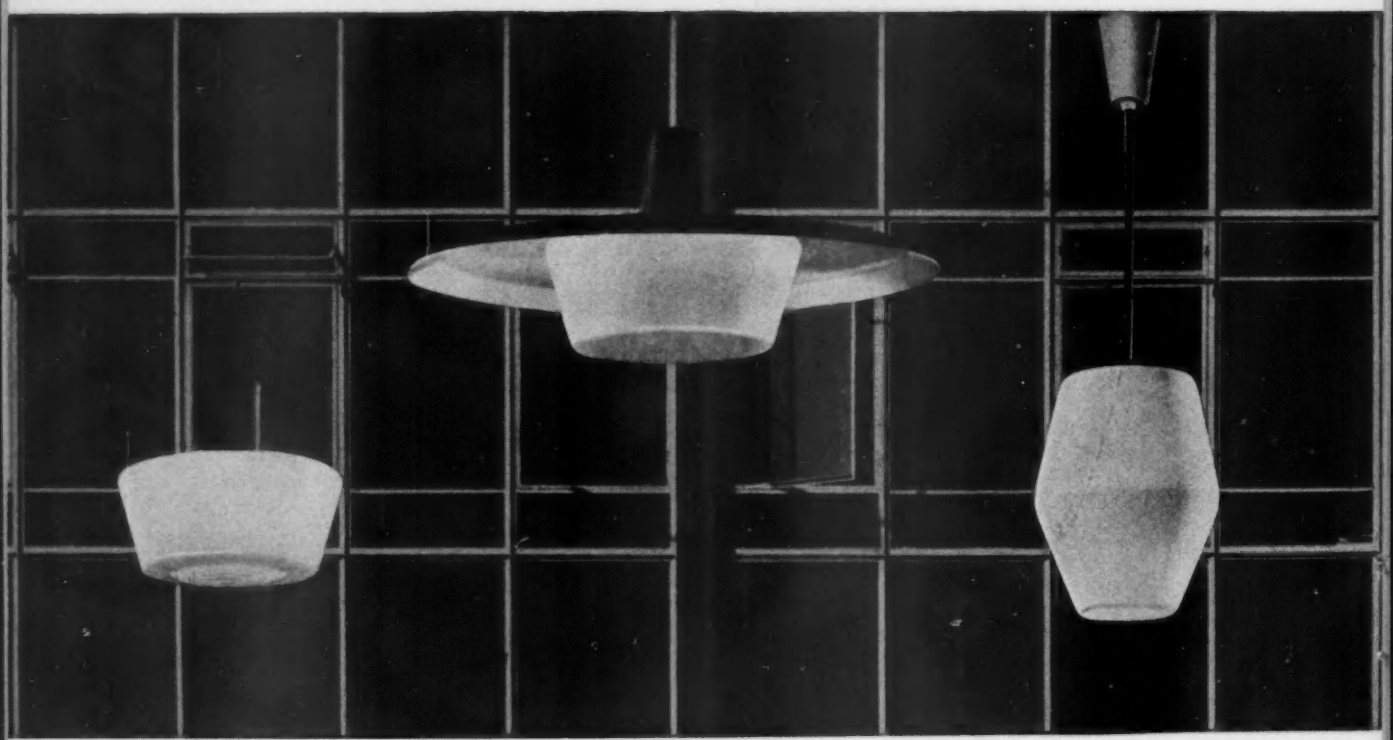

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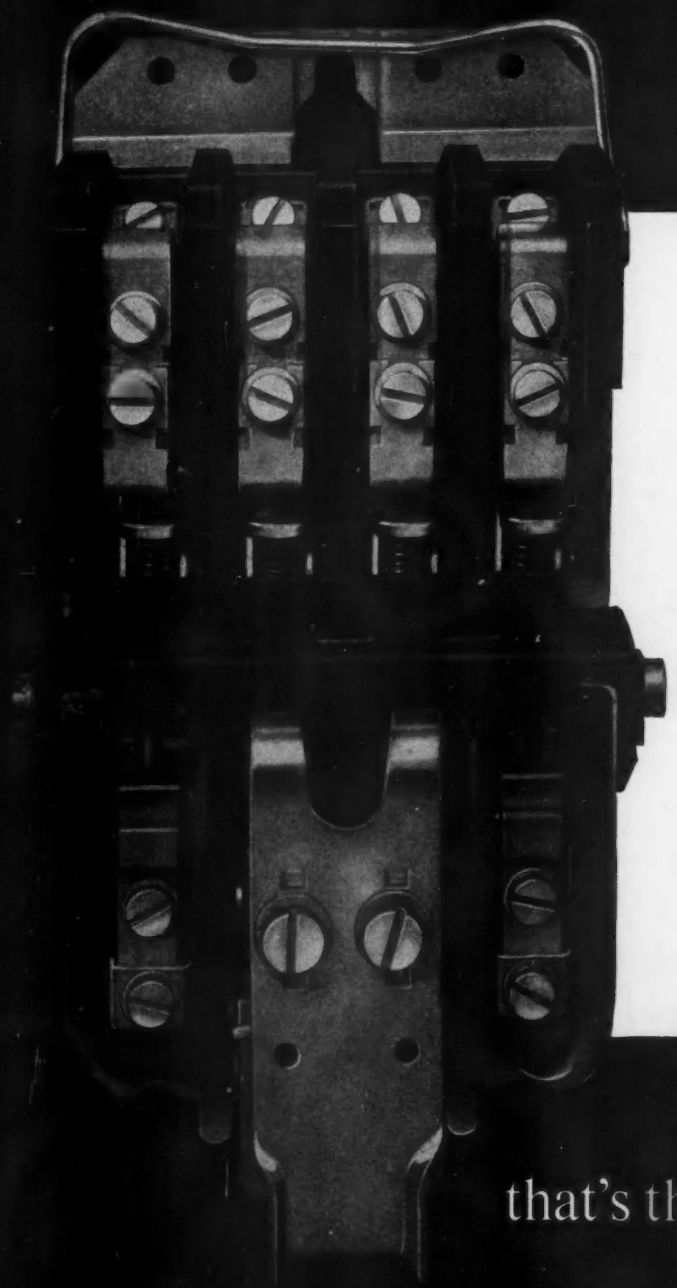

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THURSDAY 14 SEPTEMBER, 1961
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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
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Dans ce numéro

Contrôle pour le stockage de la chaleur 365

Pour commander l'équipement des installations de stockage de la chaleur, qui fonctionne sur les alimentations d'éléctricité disponibles seulement pendant les heures creuses, il est nécessaire de se servir de thermostats. Ces thermostats sont étudiés en vue de régler la durée de l'électricité reçue par l'installation soit uniquement en fonction de la température à l'intérieur, soit en tenant compte aussi bien de la température extérieure. Ces thermostats comportent un type de chauffage local qui modifie les effets de la température ambiante sur le thermostat.

Génération par des moyens non conventionels ... 373

Pour qu'une installation productrice de l'électricité donne le maximum de rendement thermique, il faudrait élever la température maximale du cycle—qui est limitée à présent à 600°C par les matériaux disponibles—à une valeur proche de 1700°C, c'est à dire la température de combustion. Il est peu probable que des matériaux, capables de se prêter à des températures aussi élevées soient mis au point, et les autres solutions seraient de faire usage d'une haute température par intermittence dans un type de moteur thermique, ou bien d'assujettir à la haute température seules les piéces mobiles qui ne sont pas soumises à une contrainte. L'usage de vapeur dans une turbine à gas offre des possibilités. Les autres méthodes de production avec un rendement relativement bas se servent des effets thermoélectriques ou thermoioniques. L'élément combustible donne potentiellement un rendement élevé, mais soulève d'autre part de nombreux problèmes mécaniques.

L'électronique appliquée aux avions 383

Les étalages d'électronique qui ont figuré au salon annuel de l'aéronautique britannique indiquent l'importance que l'on attache à la mise au point des équipements transistorisés d'atterissage sans visibilité qui se servent de calculatrices. Les nouveaux avions civils en cours de mise au point sont étudiés en vue d'emporter ce genre d'équipement qui fonctionnerait conjointement avec des câbles enfouis dans le sol ou des réseaux d'antennes.

In dieser Nummer

Steuerung von Wärmespeicherinstallationen ... 365

Bei Wärmespeicherinstallationen, welche elektrische Leistung nur ausserhalb der Spitzonlastperioden entnehmen, werden Thermostaten verwendet. Diese regeln die Dauer der elektrischen Aufheizung entweder nur entsprechend der Innentemperatur oder aber auch zusätzlich unter Berüchsichtigung der Aussentemperatur. Die Konstruktion solcher Thermostaten sicht irgeucleine Art Lokaler Heizung vor, um den Effekt der Umgebungstamperatur auf den Thermostaten abzuändern.

Ungewöhnliche Methoden der Elektrizitätserzeugung 373

Um in Kraftwerken den höchston thermischen Wirkungsgrad zu erzielen wöre es nötig die Höchsttemperatur des thermodynamischen Kreisprozesses, welche derzeit auf etwa 600°C beschränkt ist, auf 1700°C—in die Nöhe der Verbrennungstemperatur des Brennstoffes-zu erhöhen. Es ist unwahrscheinlich, dass Werkstoffe für solche Arbeitstemperaturen entwickelt werden. Eine andere Lösung dieses Problems wäre einerseits die intermittierende Anwendung solcher hoher Temperaturen in einer Art Wärmekraftmaschine oder andererseits dadurch dass nur mechanisch unbelastete Teile den hohen Temperaturen ausgesetzt würden. Eine weitere Möglichkeit wäre die verwendung von Dampf in Gasturbinen. Andere Methoden der Elektrizitätserzeugung mit niedrigem Wirkungsgrad benutzen thermoelektrische oder thermoionische Effekte. Die Fuel Cell hat einen hohen theoretischen Wirkungsgrad, doch sind damit viele schwierige technische Probleme verbunden.

Elektrionische Anlagen für Flugzeuge 383

Die auf der jährlichen Flugausstellung in Grossbritannien ausgestellten elektronischen Anlagen zeigen eine konzentration in Richtung auf die Entwicklung von Blindlandeanlagen mit Transistor bestückung und unter Zuhilfenahme von Rechenanlagen. Neue Ziviltuftfahrzeuge in der Entwicklungsstufe werden so konstruiert, dass sie mit diesen Geräten ausgerüstet werden Können. Die verfahren benutzen entweder vergrabene kabel oder spezielle Richtantennensysteme.

Control of Electrical Heat Storage Systems 365
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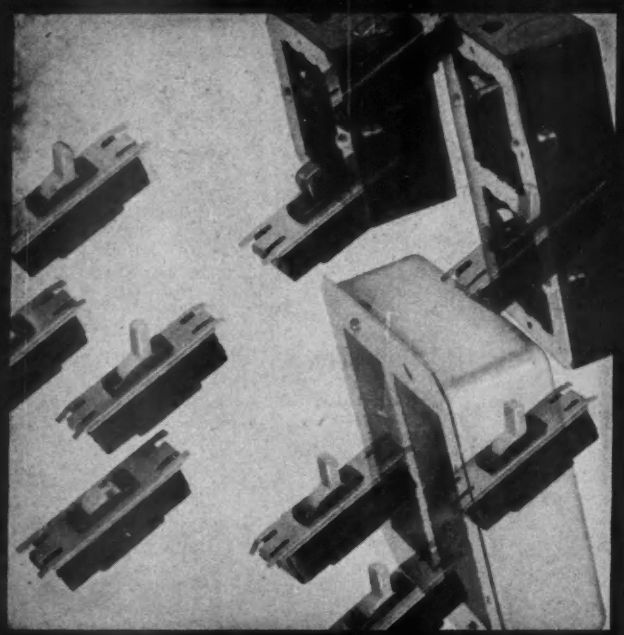

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 14 SEPTEMBER, 1961

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Comment

SEARCH FOR EFFICIENCY BREAKTHROUGH

Engineers have become used to the idea of continuing increase in thermal efficiency attainable in steam power stations. That the years of regular significant advances may be past is a possibility rarely faced. Yet, on the fascinating analysis of the basic thermodynamics of the present design situation presented by CEGB deputy chairman F. H. S. Brown to the recent British Association meeting, that is what confronts supply engineers. There will be marginal advances on the 38% thermal efficiency possible with cycle temperatures of about 600°C to 650°C, but no really big jump forward—because there is no foreseeable hope for materials able to stand substantially higher temperatures, and other possibilities for improving efficiency have been exploited to their limits. Such a conclusion is not so depressing as it may seem at first sight. There is still far to go before all the CEGB plant is operating at 38% efficiency or somewhere near that and, apart from advances in thermal efficiency, manufacturers and the CEGB can hope to make some important improvements in what Mr Brown calls the "dollar efficiency" of generating plant. But the implication is that for big improvements, something other than better steam cycles must be developed. There were presented at the BA meeting papers on MHD generation, on thermionic generation, on thermo-electric generation and on fuel cells. None of these techniques can offer high-efficiency, large-scale generation at the moment, but to Mr Brown they look a better bet than pinning supply engineering's faith in the metallurgist. But their hour of effectiveness, if it comes at all, will be well in the future. As Sir Christopher Hinton reminded a radio audience last week, an important CEGB aim is to get nuclear powered steam cycles as attractive in dollar efficiency as conventional ones before getting too worried about the more exotic techniques.

DISCOUNT DEALING

The discount store is the outstanding feature of retailing development in the USA over the past few years. Its characteristics are cheap premises in a position well removed from the plush shopping areas; cash and carry with little sales assistant attention at the shop and no after-sales service at all; and a large slice off the generally accepted price for the goods involved. In the UK, this technique of trading is only just developing and, in consequence, is being watched closely by all interested in retailing. Electrical goods, nationally advertised and subject to resale price maintenance, are an important element in British discount stores' attraction for shoppers. How electrical manufacturers use their powers to enforce

individual r.p.m. under the Restrictive Trade Practices Act will undoubtedly play a major part in determining how readily the discount store spreads in the UK. It is known that some firms have enforced their legal rights to stop price cutting where their products are concerned, and others are doubtless considering their position. The decision is a challenging one, since discount stores may, in the short run, increase total sales (through the attraction of lower prices) without cutting into the manufacturers' profits. However, to the extent that they make life more difficult for smaller retailers offering wider services to shoppers, and may cause such outlets to close down, discount houses lose some of their attraction in the long run, both to manufacturers and shoppers. So unless the law is changed—and a review of the working of the r.p.m. section of the RTP Act is still in progress by the Board of Trade—it seems unlikely that all-out discount house trading will develop in the UK as it has done in the USA.

CONTROL FOR HEATING

This year has seen important reports published, stemming from investigations of how people are liking electrical storage heating. In many of them the conclusions include a note on the need to improve the techniques of control. The problem is not easy of solution, it has to be admitted. All that can be controlled in most schemes is the time for which the heating elements are connected to the supply and the distribution of that total time within the permitted hours of supply. The result of this control is a certain temperature distribution in the fabric of the building being heated; and that has to be related to the comfort of the occupants during the following day. Intractable though this problem seems, a great deal has been achieved in relatively simple ways by taking account of both indoor and outdoor temperatures. Such systems, which are surveyed in the article that begins opposite, have as one of their main advantages the offsetting of additional "top-up" heating, applied by the building occupier during the early hours of the available period for charging the storage system. Their capabilities will be fully tried if the gamble taken by the manufacturers of block storage heaters in going for the domestic market at the cost of accepting a purchase tax imposition proves successful. Block storage heaters can in some circumstances present even more difficulties about control than floor-warming; and sensitivity to temperature is likely to be more developed in the home than in the office.

SAFETY PHILOSOPHY

Because events move so quickly in nuclear devices once anything goes wrong, analysis of the essentials of protection has probably been carried further by the UKAEA than by anyone else. Amongst recent reports on the subject is an account of the essential relationships between effectiveness of duplication of protection devices and the failure rate of those devices. (HMSO publish it as UKAEA report AHSB (S) R 23.) The report assumes that the protective installation may "fail to danger"; and that dummy faults are applied at predetermined intervals to check that this has not taken place. From the analysis, there stands out the conclusion that although a good deal can be done to reduce the risk of an "incident" by duplicating sensing instruments and tripping mechanisms, it is far more effective to keep the reliability of the protective equipment high. Reliability in this context concerns the number of faults occurring between proof testing by application of dummy faults. More frequent testing is an alternative to better equipment, but not one likely to be acceptable in most operational equipment. Where the cause of trouble lies in operating procedures rather than failure of equipment, interlocks have an important part to play, but if they are designed to be defeated during maintenance operations, only limited reliability can be placed on them in the ultimate analysis. A high standard of safety becomes a matter for economic compromise between the cost of duplicating protective equipment and that of making it to higher standards.

ELECTRICITY'S IMAGE

Selling energy in the USA is, if anything, a more competitive business even than in this country. Availability of natural gas in many areas saps some of the price attraction from electricity in heating, while the competitiveness of oil is easily imagined. So American supply companies put in some vigorous campaigning to promote sales to domestic consumers. A review of their current efforts, which we summarise on a later page, shows that this exercise is carried out in a wholehearted manner. Co-operation between many investor-owned companies results in a "Live Better Electrically" scheme which ties up advertising ideas rather as EDA does over here. Amongst the activities of that body has been investigation of how the electrical message goes over with the American housewife and family man. One of the major results is to give a freshly slanted look to those old attractions of electricity, cleanliness and safety. With an eye on the opposition, but a careful avoidance of the emphasis of a competitors' shortcomings which is unacceptable in advertising circles, the Americans have settled for the virtue of "flamelessness" as the brand image of electricity in the home. To the American at home, it seems, that term carries along with it the clean and safe concepts. It provides a picture which can be the starting point for more explicit selling. There is one snag. Electricity must not be made to look too good, for if it stresses the leisure with which it invests the housewife, father and the children will think less of her efforts for their comfort. Ways round this difficulty are found readily enough, and a major advertising campaign plugs the end-product of this £900,000 publicity operation at American consumers.

Meteor

This week's quick summary of electrical news faces advertisement page 20

Control of electrical heat storage systems

by S. O. Grant,* M.I.H.V.E.

IN spite of the many controversies which have taken place concerning electrical floor-warming and heat storage, the number of installations employing this form of heating steadily increases and there is nothing to indicate that this form of heating will not continue to gain popularity. In addition to the obvious amenities and advantages associated with these types of electrical storage heating, their importance in the national economy will increase with the development of the electrical power generation programme, as they represent a very useful contribution towards solving the peak problem in many parts of the country. It is important to remember, however, that electricity is high-grade energy, and a good measure of economic success or failure, when applied to heating, depends not only upon sound fundamental design but upon how successfully it can be controlled.

That this view appears to be shared by others is borne out by the following abstract from the Electricity Council's Utilisation Research Report No. 16 on heating school buildings by electrical and thermal storage and other methods. "Although only an approximate relationship between consumption and calculated heat loss can be expected, some of the variation between the installations is obviously due to the operation of the control systems. It therefore appears that considerable economy can be achieved by choosing a suitable control system and ensuring that it operates satisfactorily."

Before considering the behaviour of various forms of automatic control used in conjunction with electrical floor-warming and heat storage systems, it is desirable to consider the heating process itself, to ascertain to what extent this form of heating lends itself to the application of control. It is important to appreciate that electrical heat storage systems are discontinuous processes in respect of supply and demand. Energy is stored up in a heated mass during the night for use in replacing heat loss which will occur during the following day. With most other heat transfer problems, there is a continuous supply of energy on one side of the process which must be regulated to meet the changing demands of the other side of the process as required, supply and demand being kept as nearly in phase as possible.

Since there can be no perfect system of forecasting a demand before it takes place, any control action applied to an electrical storage system must be imperfect to this extent. Due to the large heat mass involved, variation in room temperature is very slow once a steady state has been reached, and this thermal inertia will take care of those instances when a cold night does not happen to be followed by a cold day, and vice versa. Provided that during a 48-hr or 72-hr period the controls provide a heat input commensurate with the losses, the degree of control possible—and hence economy achieved—is remarkable. Thus, the importance of the outside temperature condition prevailing during the charging period can be established as an important factor in a control system.

Similarly, the state of the inside temperature at the beginning of the charging period is important in determining the duration of a subsequent charge. The inside temperature at the commencement of the charge indicates to what extent the previous night's charge has been successful in maintaining the desired level, whether there has been a heavy incidental heat gain during the day's occupation or a heat loss greater than expected.

The inside temperature at the end of the charge is also important, because this figure indicates the final condition at the moment when no further control action can be taken. This figure, examined daily, is the only criterion as to how successfully, or otherwise, the control system is behaving.

Control Methods

There are three control methods in common use:

Room thermostats controlling sections of the storage load without any other associated control other than the supply authorities' time switch.

Temperature/time regulators, employing a timing mechanism to regulate the duration of the charging period in conjunction with temperature sensing elements which respond to inside temperature, outside temperature, or a function of both.

Thermostat combinations which take account of inside and outside temperature during the charging period.

These control methods will be considered in order.

Room Thermostats

Fig. 1 shows a simple bimetallic type of room thermostat. A bimetallic strip fixed at one end to an adjustable hinge provides a means of setting the temperature to the

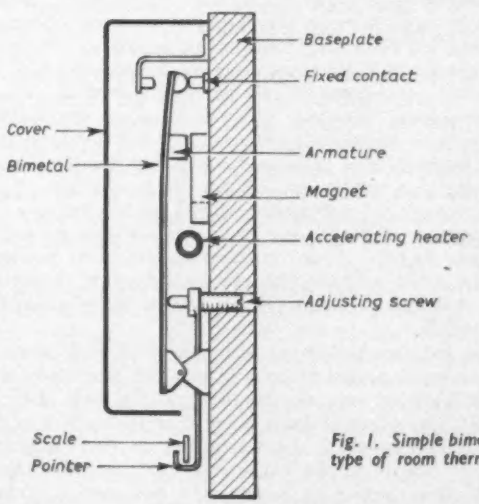


Fig. 1. Simple bimetallic type of room thermostat

* Mr Grant is London manager, The Rheostatic Co. Ltd.

desired level. At the other end the moving contact assembly is mounted, while the fixed contact is rigidly attached to the base. Changes taking place in the surrounding air temperature cause the bimetallic strip to warp, this movement being employed to open and close the contacts. Usually some snap mechanism is employed to give a clean make and break of the switch. The thermostat shown in Fig. 1 employs a magnetically controlled microgap switch which gives a particularly consistent and reliable action over long periods. In any well-designed instrument a current-carrying path is provided so that the bimetal does not actually carry the load current and so become unduly self-heated. Although a bimetallic type of instrument has been shown in diagrammatic form, the temperature sensing element might equally well be a bellows system operating the contact assembly via some suitable lever system. This simple form of room thermostat behaves as a thermally operated switch, which requires some change in temperature to overcome its own mechanical resistance and force the contacts to open; likewise, some change in temperature in the opposite direction must occur to allow the contacts to close again. The difference in temperature, which must take place between opening and closing of the contacts, is known as the temperature differential of the instrument. For the sake of simplicity, the mean control point may be assumed as being mid-way between this upper and lower point.

Such an instrument would also be known as an unaccelerated type of room thermostat. Although an unaccelerated type of room thermostat can be made to operate with quite a small differential, say 1°F or less, the performance of such instruments in most space-heating applications can be markedly improved by the addition of an accelerating heater. The reason for this addition and the effect on the instrument is often imperfectly understood. The following example is given to clarify room thermostat behaviour in general in space-heating applications.

Accelerating Heater

Consider a room heated by an electrical convector. Imagine that the room is at a steady state of 65°F when heat loss causes a drop in temperature of 1°F. The convector is controlled by an unaccelerated room thermostat set at 65°F with a total differential of 2°F. When the air surrounding the instrument falls by 1° to 64°F, the contacts will close and the convector will start to heat the room. The room is a space representing a large capacity and, through this large body of air, convection currents have to move, transporting heated air throughout the space. This all takes time and represents lag. The principal component of this delay is known as velocity/distance lag. The effect of lag is to cause the heater to be "on" for lengthy periods and "off" for lengthy periods. This is undesirable in space heating as it has the effect of allowing the temperature of the heating surface to fluctuate over an undesirable range and, therefore, the temperature of the heated space varies unduly as well.

Such fluctuations in temperature are very noticeable to the human body, giving rise to a sense of discomfort, and obviously it is desirable to provide better modulation if possible.

The solution usually adopted, therefore, is to introduce a very small degree of heating into the thermostat itself, which switches on and off in sympathy with the main heater. The effect of introducing a small amount of heat like this is to cause the thermostat to become satisfied earlier than it would have been from surrounding air temperature alone; its action thus becomes accelerated. When the thermostat contacts open, the accelerating heater is disconnected and the instrument cools, eventually switching on the source of heat once again to repeat the cycle. The amount of accelerating heat provided must be very carefully limited because, if too great, the control point will be unduly "off set" or depressed as the load increases. A little further investigation will show that the effect of acceleration is to alter the characteristic of the instrument from "on" and "off," or two-position control, to one having a proportional control action. It no longer possesses a true temperature differential, but assumes a "proportional band."

Proportional Action

The definition of a proportional band is "that change in temperature required to bring about 100% control action" and may be explained as follows. With acceleration, which causes heat to be delivered in pulses, there must be, for a given setting, some space temperature low enough to retain the contacts closed all the time. Similarly, there must also be a space temperature which, with the same setting, will cause the contacts to be open all the time. With a mean control point of 65°F, suppose a temperature of 67°F in the surrounding air is found to be just high enough to keep the thermostat contacts permanently "open" and that a temperature of 63°F is found to be just low enough to keep the contacts permanently closed. The instrument can then be said to have a proportional band of 4°F. In between these two temperatures, which represent 100% load condition and no load, i.e., on all the time and off all the time, the instrument will behave approximately as shown in Fig. 2. The line is, in practice, not straight, but for the purpose of this article it can be considered as linear. The instrument will switch on and off in a series of pulses, the percentage time "on" being zero at no load to 100% time "on" at full load. From the Fig. 2 it will be noted that at 66°F the ratio of time "on" to time "off" will be such as to give "on" periods representing only 25% of maximum. At 65°F 50% time "on" and 64°F 75%, and so on, varying from zero to 100% time "on" over the proportional band of the instrument.

An accelerated room thermostat is thus a proportional controller rather than an on/off controller. It tends to regulate the output of the heater by pulses, the duration and frequency of the pulse increasing with the load. It should be emphasised, however, that all proportional controllers suffer from offset. This means that as the load increases the effective control point is depressed and, if the proportional band is made too large, the control point may be depressed to an unacceptable extent. Similarly, if made too small, all proportional effect will be lost.

The foregoing example is given to demonstrate the behaviour of room thermostats and the effect of the accelerating heater, irrespective of the type of load it is set to control.

Consider now what is likely to happen when a room thermostat is employed to control an electrical storage heating system, remembering that no control at all can be exercised during the period when heat is actually required during the day, since no energy is available. All a room thermostat can do is regulate the duration of charge as a function of the space temperature when energy is provided.

With an unaccelerated type of thermostat the load will be switched on whenever the space temperature is just below the differential, and remain on till the space temperature is just above the differential. Due to velocity/distance lag and the fact that room temperatures vary

slowly with thermal storage installation, this can lead to undue lag in response. For example, if the room temperature, due to incidental heat gains, was just above the thermostat setting when the supply became available for charging, the charging period might be unduly shortened in relation to the outside temperature prevailing. Similarly, the opposite effect might be experienced in the case of mild weather following a cold spell, i.e., there could be a tendency to take a greater charge than necessary. The result is that, assuming a constant night temperature over three nights, the system would cycle, in that on the first night a full charge would be given, the second night no charge and the third night a full charge would be given.

If an accelerated type of thermostat is used, the tendency to remain on or off for a long period is eliminated because of the pulsing effect, but if care is not exercised in selecting the correct temperature setting, the charging period may once again be restricted. This means that an accelerated type of room thermostat may have to be given a setting slightly higher than the room temperature desired to compensate for the pulsing effect, which tends to spread the charge over a longer period. The room temperature has to fall through the proportional band (in the above example, 4°F) before a 100% charge is obtained, and often this is undesirable.

One word of warning is needed in this connection. There are a large number of room thermostats on the market and tests have shown that, in the case of some of these, self-heating, particularly at high loadings, i.e., 20 A or so, is so great that the instrument ceases to have any proper control at all. Quite apart from any other consideration, the wattage loss at the contacts can be quite appreciable if care is not exercised in design, a point which sometimes seems to be forgotten.

In spite of some of the problems referred to above, provided that a reliable type is selected, and it is carefully positioned, either an accelerated or an unaccelerated room thermostat will give reasonable control. These instruments are popular because of the ease with which they can be installed and wired to an individual section of the load. However, the conditions described above can now be overcome by the use of an additional overriding inside/outside control such as that described later.

The main shortcoming of a room thermostat of any sort is that of limiting the charge from 7 p.m. if additional (non-restricted) top-up heat is used to obtain comfort conditions. This additional heat will cause the thermostat to remain open until the room temperature drops. This can cause only a small charge to be given, when really a large one is required. The following evening, due to the small charge, even more top-up heat is necessary.

Temperature/Time Regulators

From a consideration of room thermostats it will be appreciated that all a room thermostat can do in controlling off-peak thermal storage is to regulate the length of charge in relation to the space temperature condition which prevails during the period when electrical energy is available.

It has been clear to many that such a control system may not adequately take into account the prevailing heat loss conditions due to outside temperature and, for some considerable time, controllers have been designed to regulate the length of charge wholly determined by outside temperature conditions.

A system of control can be devised whereby the charging time is directly related to the outside temperature. For example, a series of time switches could be set to give "on" periods of 3, 6, 9, and 12 hr, all terminating at 7 a.m. These four time switches could be wired in series with four outside thermostats set at 30°F, 38°F, 45°F and 53°F. The combination of switches and clocks could be wired in parallel and in series with the load contactor and time switch. If, then, the outside temperature is below 30°F, a 12-hr charge would be selected and if at 45°F, a six-hr period, and so on, but in this case no charge would be received with an outside temperature in excess of 53°F.

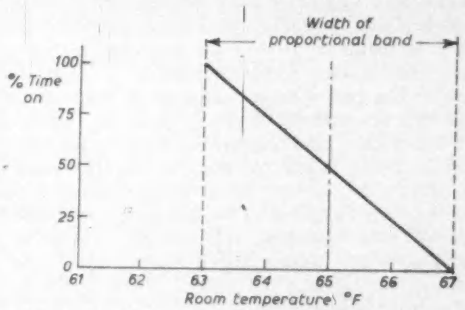


Fig. 2. Proportion "on" for temperatures over the proportional band for a typical accelerated room thermostat

A better time-temperature arrangement would be to employ a special time switch combined with a thermal device so that the "on" time was continuously varied with change in outside temperature, and this is what the thermo time regulator employed for controlling electrical thermal storage sets out to do. In some quarters it is felt that this is the best control to apply, but this belief is largely based on the idea that it must be an advantage to make the actual duration of charge, be it long or short, as late in the permitted period as possible. For example, suppose a three-hr charge is being given then, say some authorities, it should be between the hours of 4 a.m. to 7 a.m. and not from 7 p.m. to 10 p.m. This idea, no doubt, arose in connection with block storage heating, where it is difficult to get enough thermal storage mass and the block is taken up to much higher temperatures than would be the case with underfloor heating. Such an argument has less validity where adequate storage is provided, as is the case in most underfloor heating installations. In fact, the additional heat liberated, because of a higher floor temperature early in the night rather than first thing in the morning, is so small that the heat gain cannot normally be measured.

The design of the building being heated and the occupational habits of the users must also be taken into account. In flats, for example, it may be most desirable that charging starts just as soon as energy becomes available at 7 p.m., particularly if the underfloor heating has been designed on the basis of background heat only. On the other hand, with underfloor heating installations designed to give full comfort conditions, these matters are not so critical.

It has been found, for example, that with a properly designed electrical floor-heating installation, the floor temperature will drop only 2°F or 3°F during a cold day and even less on a mild one. Such small temperature changes in association with a large thermal mass mean that it makes very little difference when the charge is put in in relation to the 24-hr cycle, but the duration of the charge is, of course, extremely important. The additional loss of heat resulting from the floor being at, say, 76°F at midnight and 77°F at 3 a.m. rather than 75°F

at 4 a.m. and 76°F at 7 a.m. is so small as to be negligible.

The thermo-time regulators by Robert MacLaren Ltd. are some of the best known in this field and have been selected for a rather more detailed description with the aid of Fig. 3. A 24-hr clock drives a programme cam. By means of a cam follower the cranked main lever is moved, but it will be seen that the thermostatic element also operates the same lever. The arrangement is such that the regulator switch responds to the sum of two variables, time and temperature. In the case of the Model TR/L-B, the temperature sensing element consists of a liquid-filled bulb connected to a bellows by means of an inoperative capillary tube.

As the temperature of the air surrounding the bulb increases, the bellows expand, applying a force to the lever main. The cam follower actuated by the time-driven cam has to overcome this force to close the switch. The time at which the switch closes may thus be advanced or retarded according to the temperature. The right hand end of the lever is an ambient-temperature-compensating bimetal to prevent changes in air temperature surrounding the bellows from interfering with the performance of the temperature sensing system. Obviously, changes in the air temperature surrounding the outside bulb should be the only operative factor.

In the case of the Model TR/B, no bellows system is employed; the temperature sensing element is a simple bimetal housed inside the instrument case. It is obviously less costly than the TR/L-B, but the whole instrument must now be mounted outside the building.

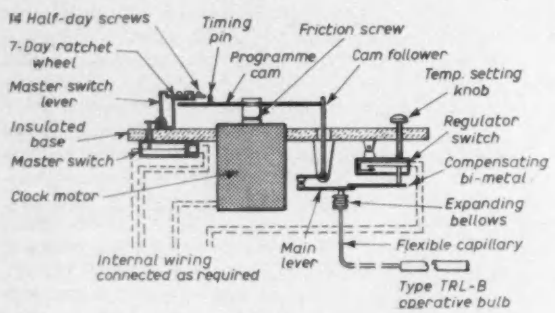


Fig. 3. Mechanism of MacLaren thermo-time regulator

With these models, clocks having spring storage can be provided, also a day-omitting device, as optional extras. An even simpler model known as the TA has now been produced, sold in one standard form with no optional extras, at a reduced price.

A selected programme, either designed by the customer or suggested by the manufacturer, is set by cutting the cam. The cam consists of a 4 in. diameter soft brass disc which can be shaped by hack-saw and file. The time scale and equi-temperature circles are marked on the disc, which is marked off and cut to give the required programme. Standard off-peak programmes are available. The outer circumference of the cam represents the highest temperature (normally 70°F) with temperature divisions of 10°F. Time setting is carried out by rotating the disc cam until the correct time is opposite the follower arm. Care must be exercised in cutting the cam to avoid flats, which would prevent a smooth proportional action. Temperature setting is performed by rotating a knob. Rotation of the knob lowers the setting so that the heat is switched on later.

The manufacturers at one time made the thermo regulator suitable for controlling as a function of inside and outside temperature. This was done by making the liquid-filled sensing element in the form of a long, narrow bulb. In effect, a larger tube was used, dispensing with the capillary so that the whole length became temperature-sensitive. By arranging for part of the tube to be outside the building and part inside, the force exerted by the bellows became the sum of the two temperature effects. It now appears that the manufacturers no longer recommend the practice as being satisfactory. Instead, they recommend that the device is used as a means of setting the duration of charge according to the outside temperature only.

There are other versions of electrical thermal storage controller, such as one made by Salford Electrical Instruments Ltd., and another known as the Repitrol. The essential point is that they all regulate the duration of the charging period in response to outside temperature during the night.

In the SEI controller, when the time switch has closed, the setting of the outside thermostat is swept over a range of 25°F. The time switch starts a cam regulating the adjustment of the thermal element to, say, 30°F and therefore, if the outside temperature is below the figure the load contactor will close early. If the temperature is above this figure, the time for switching on the heat will be delayed until the cam has slowly raised the set point

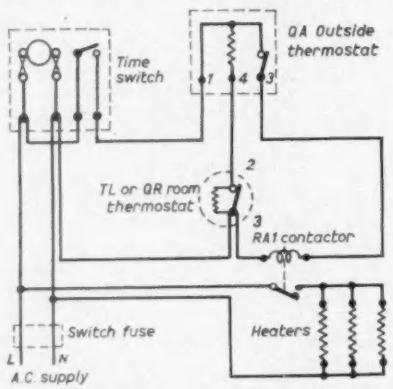


Fig 4. General arrangement of Satchwell QA/QR system

of the thermal element to match the outside temperature.

The Repitrol is a Wheatstone bridge version with a similar purpose. A temperature sensing leg of the bridge responds to outside temperature, while the balancing leg of the same bridge is provided in the form of a motor-driven potentiometer. The time-switch motor slowly drives the arm of the potentiometer over its full range. This, in effect, is raising the temperature at which the bridge will come to balance in relation to time, as described above. With the bridge system, obviously the temperature sensing leg can be made up of one or more elements so that the temperature signal could be a function of one or more temperature variables, i.e., outside temperature and inside temperature. Bridge systems would seem of necessity to be rather more expensive to produce; this at a time when, due to the rapid growth of underfloor and thermal storage electric heating generally, cheaper means of effective control are in demand.

Inside/Outside Temperature Controllers

Having considered a control method which regulates the duration of charge solely as a function of inside temperature, and then reviewed control methods which set

the duration of charge entirely as a function of outside temperature, it is logical to investigate what methods have been developed which regulate the duration of charge as a function of inside and outside temperature together.

One such scheme is known as the Satchwell QA/QR. The wiring diagram, Fig. 4, makes the general arrangement clear. The storage heating load is controlled via the time switch through the contacts of an outdoor thermostat which operates the coil of the load contactor. The outdoor thermostat is mounted in a water-tight enclosure which is provided with a heating element. This heating element is capable of giving a rise of 30°F to the air inside the enclosure. The thermostat inside is set at 60°F. The heating element in the outside thermostat is controlled by a reverse-acting room thermostat inside the building; this has a proportional band of 4°F, approximately. For a desired level of temperature inside of 65°F, the room thermostat is set at 65°F. If, when the time-switch closes, the outside temperature is below 30°F, the storage system will receive full charge. Even if the space temperature was high enough to keep the contacts of the room thermostat closed all the time, i.e., 67°F, the heater in the outside thermostat could only give a rise of 30°F and the thermostat inside the outside thermostat

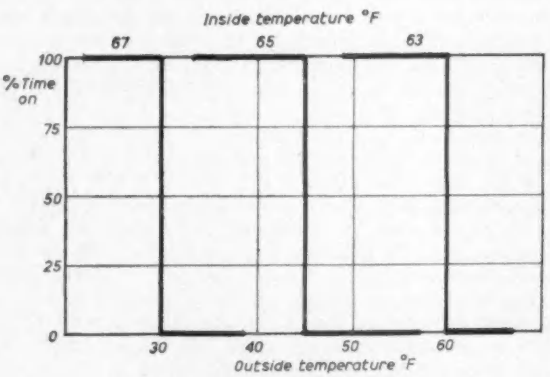
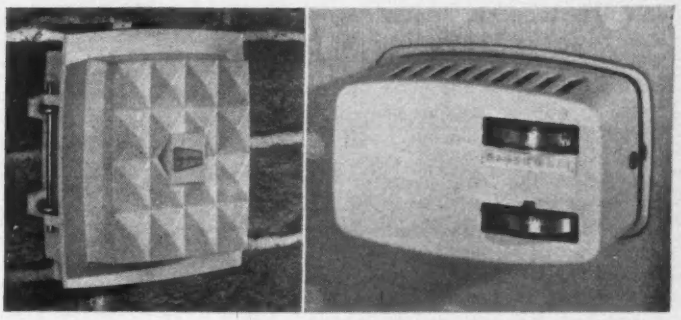


Fig. 5. Characteristics of QA/QR system

case is set at 60°F. If, on the other hand, the outside temperature was 45°F, a rise of just over 15°F in the outside thermostat case would cause the contacts to break and thus open the load contactor. To give this 15°F rise, the heater would require to be energised 50% on and 50% off. If the remarks concerning the proportional characteristic of the accelerated room thermostat are remembered, then it will be appreciated that this will happen in the case under discussion with the inside temperature at 65°F, i.e., half-way in the proportional band between 63°F and 67°F. With an outside temperature below 45°F and a room temperature of 65°F, or less, the storage would get a full charge.

What is happening, therefore, with this scheme is: the outside temperature required to switch on the thermal storage is being raised and lowered between the limits of 30°F and 60°F, according to the inside temperature (see Fig. 5). This arrangement has proved very effective and has been referred to by many of the authors who have written on the subject of electrical thermal storage. Tests which have been taken indicate that it is the best method of control so far available, even though it has the disadvantage that it will reduce the size of the charge in



Figs. 6 (left) and 7. Typical outside and inside elements for Ratiomatic Control

the event of high room temperature. It is much better than plain room thermostat control, particularly for the underfloor heating and block storage systems, but recent research by the Rheostatic Co. Ltd. has shown that a modified arrangement of inside and outside thermostats can give even better results on floor-warming storage systems. This new arrangement is known as the Ratiomatic Control. A typical room thermostat (inside element TL), together with the outside element TMA, are illustrated in Figs 6 and 7.

This new arrangement is based on using the outside thermostat as a loss meter. If the outside thermostat is considered as an enclosure provided with an internal heater having a thermostat in series, it becomes, in effect, a very small heated room and will endeavour to maintain its own temperature at the thermostat setting against heat lost to the surrounding air. Assume the internal heater can raise the temperature of the enclosure by 30°F and the thermostat to be set at 60°F. When the outside temperature is just above 60°F the heater will be continuously disconnected; similarly, when the temperature of the surrounding air is just below 30°F the heater will be continuously energised.

In between these two ambient temperatures the percentage "on" will vary, diminishing from 100% to zero as the outside temperature rises from 30°F to 60°F. The instrument in this form can thus be used to indicate a function of the heat loss to which a heated building might be subjected in the same environment.

On its own, such a heat loss meter is not always the complete answer because, first, use can only be made of the heat loss conditions during the actual charging period rather than the complete 24-hr cycle and, secondly, it cannot pay regard to the internal temperature at any time. For the control of underfloor heating installations, excellent results have been obtained by using a loss meter in the form described above, wired in series with an accelerated room thermostat in the manner shown in Fig. 8. For the sake of simplicity, let it be assumed that the room thermostat is again set to a mean control point of

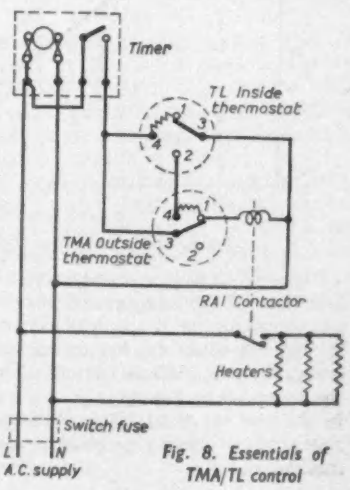


Fig. 8. Essentials of TMA/TL control

65°F and that it possesses a proportional band of 4°F, i.e., 63°F to 67°F.

With this combination, if the room thermostat is just above 67°F, terminal 3 will be continuously connected to terminal 2 and therefore the outside units act as a simple loss meter since the load contactor will switch on in sympathy with the loss meter heating element, the amount of energy put into the floor will vary from zero at 60°F outside temperature, to 100% when the outside temperature is 30°F. On the other hand, when the room temperature is below 63°F, terminal 3 will be continuously connected to terminal 1 and the heater in the outside unit is disconnected. When this happens the system will receive a full charge, provided the outside temperature does not exceed 60°F. The internal temperature is now low and a full charge is indicated, irrespective of outside conditions.

For the internal temperatures between 63°F and 67°F the percentage "on" periods of the room thermostat will vary between 100% and zero. At 65°F internal temperature the room thermostat will supply about 50% of full energy to the loss meter element, making possible an effective rise of 15°F to the TMA enclosure. Thus, with a steady state represented by 65°F inside and 45°F outside, the heating system would receive its full charge (Fig. 9). With an inside temperature of 66°F the percentage "on" for the room thermostat would be only 25%, reducing the effective temperature rise in the loss meter element to 7½%. The outside temperature would have to be below 37½°F to give a full charging period. At the same inside temperature, and 45°F outside, the charge into the floor-heating system would be 66%. If the room temperature had fallen to 64°F the system would receive a full charge with the outside temperature as high as 52½°F, but if the charge was based on outside temperature alone it would only have received 25%.

These remarks demonstrate the principle and would refer in particular to an underfloor-heating installation in a private dwelling-house designed to give full comfort and in use seven days per week during the heating season.

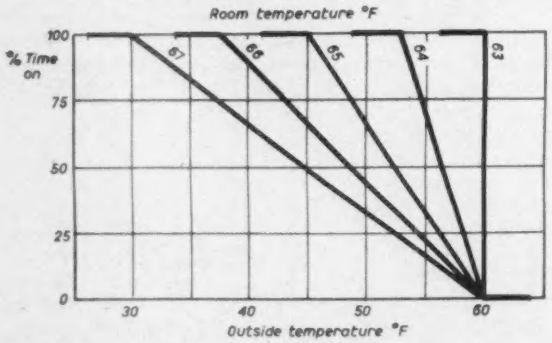


Fig. 9. Characteristics of TMA/TL system

Fig. 10 shows a comparison between the control behaviour of the Ratiomatic control and that of a thermo-time regulator. Both are delivering a 50% charge into the system, but while the Ratiomatic spreads the delivery of energy over the whole period when supply is available, the thermo-time regulator is delivering the whole charge in the last six hours. The Ratiomatic control must, of necessity, be cheaper to produce as it requires no clock mechanism.

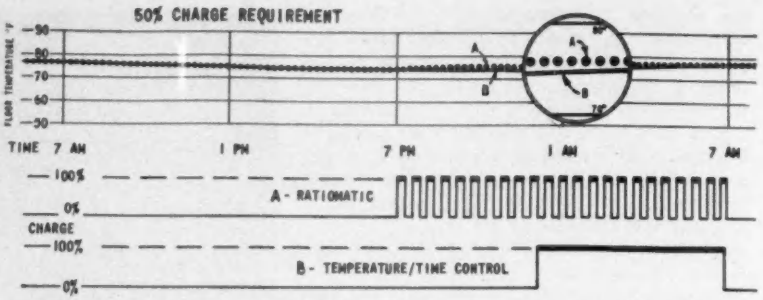


Fig. 10. Comparison between control behaviour of Ratiomatic control and thermo-time regulator

In comparing thermo-time regulators with inside/outside controls, it should be remembered that the Ratiomatic is using as criteria the actual losses, including those due to windage, and the inside temperature; the thermo-time regulator does nothing more than switch on at a point in time fixed by the coincidence of two curves. One is the curve of time and temperature of the cam, and the other is the graph of outside temperature. The time of switch-on has no real reference to the temperature prevailing before or after the switch-on point, the losses from the building or the inside conditions.

The Ratiomatic as a form of inside/outside control also has the advantage that under some conditions it can increase the size of the charge during the last few hours. Assume a 50% charge is required because of the prevailing conditions. The thermo-time regulator will switch the heating load on at, say, 1 a.m. The Ratiomatic will cycle on a 50% on and a 50% off basis. If at 2 a.m. or 3 a.m. the outside temperature suddenly drops, the Ratiomatic can, and will, detect the fall and will put in a full charge for the rest of the night. It will be able to give a charge nearer to the ideal than could a thermo-time regulator.

It should also be emphasised that while the inside thermostat in the Ratiomatic system can override the outside element to give a greater charge should the room temperature be too low, it can never override in such a manner as to reduce the appropriate charge determined by the outside temperature prevailing. Put simply, it increases the charge when the room temperature is below the desired level, but it never reduces the charge because of a temporary high room temperature.

For application to installations where design has been based on background heat only, the wattage available in the outside element would be modified to suit, but the use of electric fires cannot make the internal element reject the basic charge, which will be determined by outside temperature conditions.

When referring to a permitted charging period of 12 hr it should be clearly understood, in particular reference to block storage heaters, that the makers' recommendations should be strictly adhered to in respect of maximum duration of charge. For block storage heaters the maximum duration of charge may be restricted to a period of 8 hr or so to prevent overheating of the blocks.

Floor Thermostats

In concluding this article, some reference should be made to floor thermostats although, except in very special applications, such devices are now rarely employed except as limit controls. They are hardly ever employed as a primary means of controlling underfloor heating, but some authorities stipulate that a certain floor temperature must not be exceeded. It is most important to remember that any such device must have a very small working differential. If this is not so, much stored heat may be lost.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Current Balance E.L.C.B's

REFERRING to the suggestion that current balance protection should be adopted in preference to voltage-operated earth leakage circuit-breakers, I would point out that, in view of IEE Regulation 410, a 30 A differential circuit-breaker may operate on an earth leakage current of 5 A and meet the regulation. Thus, in order theoretically to restrict the voltage to earth to, say, 50 V, infers an earth conductor impedance not more than 10 ohms, whereas in rural areas, where earth leakage protection in place of overload protection (fuses) is called for, the impedance of the earth conductor may approximate 50 ohms or more.

As the average earth leakage circuit-breaker operates on approximately 40 mA, the theoretical voltage to earth is 20 V. Further, either system does require an intact earth conductor in order to guarantee operation; thus, for reliability of operation and hence maximum safety, either system of protection requires some form of earth conductor monitoring.

C. H. Nicholson, M.I.E.E.,
HULL.

No Faith in Instruments

PANEL instruments are usually operated within a relatively small range of values on the scale. For example, an operator will know that on "No. 1 circulating pump" he will always see, say, 17 A if the circuit and pump are running normally. Or, perhaps, on an oil cooler pressure gauge, he expects to see 40 lb/sq in. and nothing else.

The point I have noticed, over several years of power station work, is the curious "blindness" to any reading other than that which is expected. It is a common experience of mine that, should an instrument not read the expected value, then it is considered that the instrument is faulty. I could detail at least ten cases over the past four years but I will mention one.

A heavy panel ammeter had been in service for at least 30 years and read approximately 400 A. After a switching operation in a remote substation its reading fell to zero. This was reported by the operator to the engineer on duty. The engineer noted that the circuit was being fed (parallel operation) and pronounced that the ammeter had become faulty.

It was actually removed from the panel and, at this point it was, in fact, found to be quite serviceable. In other words, though it was "telling the truth" when it showed zero current, it was not believed because "everyone knew" it should read 400 A.

I have seen this sequence of events repeated many times over the past few years, with voltmeters, ammeters and pressure gauges. I wonder whether it is unusual at large.

W. A. Bold,
URMSTON, LANCS.

Off-peak Heating Design

THE electrical industry must not be disinterested in understanding electrical heating. Floor-warming has kindled our interest and provided an introduction to the difficult problems of our friends in the heating engineering profession.

To foster this interest and to invite heating engineers to give us the benefit of their experience, I would welcome opinions on one further possible explanation of the "apparent anomalies" of floor-warming.

Let me make it quite clear that I have no intention of proving electrical floor-warming to be necessarily the ideal system which would have the minimum heat requirements.

"Conventional" heating systems supply heat inside the room to warm the floor (Q_f), the fresh air (Q_a), the walls, etc. (Q_w). The total rate of heat input is, therefore:

$$H_t = Q_f + Q_a + Q_w \text{ B.Th.U./hr}$$

Floor-warming supplies heat to the room to warm the fresh air and the walls, etc.

The total rate of heat input is, therefore:

$$H_t = Q_a + Q_w \text{ B.Th.U./hr}$$

The heat required to warm the fresh air and walls, etc., also warms the floor. This heat, therefore, satisfies two requirements towards providing comfort, whereas with "conventional" systems the heat required to warm the floor is lost to the outside. It is customary when designing floor-warming, to add the floor loss as a separate item to the heat requirements.

There is, therefore, a loss of heat from the surroundings (floor) to the room which is the opposite condition to the conventional direction of flow. What a wonderful heating system we would have if the heat required to warm all other parts of the structure could be lost to the room and not to the outside!

The reduction in the room heat required is usually allowed for by reducing the allowance for air changes. This method of correction does not appear to be really satisfactory. The heating profession might find it possible to agree with the explanation and recommend how the allowance should be made.

W. H. Tibbs,
ALWOODLEY, LEEDS, 17.

Water Heating Bills

I HAVE read with considerable interest the recent letters in connection with the economics of water heating.

I would agree with Mr Lawrence on the point he makes in reply to Mr Honey regarding the difficulty experienced in obtaining satisfactory thermal insulation on existing storage tanks.

My own installation consists of two approx 9 in. dia vertical cylinders joined by horizontal pipes at top and bottom, giving 25 gal of storage. This design, which appears to be gaining in popularity, allows the storage tank to be accommodated in a shallow cupboard formed by the chimney breast brickwork.

However, a direct result is that satisfactory insulation becomes very difficult, and I find that with the best possible insulation, glass fibre covered by aluminium foil, the standing loss amounts to some 30 units/week. This represents a waste component of approx £7/annum at 1·1 pence/unit, or 14% of the total electricity consumption of my all-electric house.

It therefore follows that hand- or time-switch operation are the only alternatives if a saving is to be made without plumbing alterations.

I note that Mr Honey has installed in his home a combination cylinder/cistern which is insulated by 1 in. of

glass fibre and suggests that it is very effectively lagged. It is interesting to look back to an article which appeared in the ELECTRICAL TIMES this year (23 March) describing an experiment carried out by the SWEB using a similar storage tank.

In this case the thermal insulation consisted of a 1 in. thick fibreglass mat followed by a 1 in. thick sectional jacket and further covered by a second jacket covering two-thirds of the combined unit. The author then states: "In spite of this amount of lagging the standing loss of cylinder, cistern and adjacent pipework amounted to 21 units/week."

In consequence of this statement and my own experience, I wonder if Mr. Honey has, in fact, achieved a degree of insulation that justifies his original statement in reply to *Megohm*?

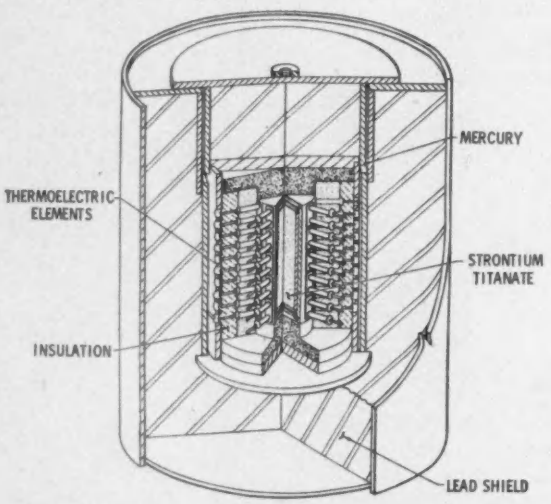
Finally, I would be interested to hear of any comparative figures that may be available showing the saving, if any, that may result from the use of a double heater rather than the standard single-element unit. This should, I imagine, restrict the loss by cutting down the storage and may be an answer to the serious problem of economic water heating in existing houses, which are presently being converted to electricity.

G. W. McIlwrick,
EDINBURGH 12.

Power for Weather Reporting

POWER sufficient to operate instruments and a radio transmitter at an Arctic weather station is being obtained from a thermo-electric generator which has been developed by the Martin Co. of Baltimore, USA. Heat to generate electrical power in the thermo-electric device is obtained from the nuclear isotope, strontium 90.

Known by the code name Sentry, the generator is housed in a cylinder 18 in. dia, 20 in. high, with a total weight of 55 lb. Contained in the generator is about 1 lb of strontium 90. This is an isotope with a half-life of 28 years, which gives off beta particles (electrons). In the pure form it has a specific heat output of about 0·92 W/gm; but the strontium is, for safety reasons,



Construction of the "Sentry" power generator

present in the device as an insoluble, practically indestructible compound, strontium titanate. This has a much-reduced specific heat output; in terms of volume, it has been estimated at 0·54 W/cu cm.

As a further safety precaution, the entire Sentry power unit is enclosed in lead, with an outer shielding of stainless steel. Station and power source are housed in a cylindrical insulated container about 8 ft high, weighing about 1 ton. The lower 5 ft of the container is buried in the ground.

The weather station is at present being operated in the most northerly part of Canada, on Axel Heiborg Island. It is arranged to send measurements of wind direction, wind speed, temperature and barometric pressure every three hours.

Satellite Power

Another generator which is radio-isotope-powered is installed in an American navigational satellite, Transit IV-A, which was launched from Cape Canaveral at the end of June. This generator is slightly less powerful, producing 2·7 W electrical output for the satellite's instruments and for two of its four radio transmitters. For fuel it uses plutonium 238.

As an energy source for thermo-electric generation, plutonium 238 has advantages over strontium of a longer half-life—90 years—and of higher power densities. The power unit itself is roughly spherical in shape and weighs slightly less than 5 lb. The total weight of the navigational satellite which it powers is 175 lb.

The design of the power unit is based on the principle that it will burn completely when the satellite returns from space and re-enters the earth's atmosphere. Resulting fine particles of plutonium 238 will be dispersed harmlessly in the stratosphere, where they will remain for a long period of time, with no measurable quantities of radiation descending to earth as a result.

Semiconductor Elements

Six years of research have contributed to the working efficiency of thermionic generators. Much of this has been carried out under the US "SNAP" programme—letters standing for systems for auxiliary nuclear power.

Relatively little information is available about the thermo-electric components of the generators. The accompanying illustration shows the general construction of the Sentry unit, and an arrangement of n-type and p-type semiconductor elements around the radio-isotope heat source have been used in earlier generators in the SNAP series.

Safety Philosophy

THE UK Atomic Energy Authority report mentioned by *Meteor* under the above title is "Reliability of Protective Systems for Zero-Energy Reactors," by Messrs D. Wray and M. J. Cowper, of the Safeguards Division, Health and Safety Branch. Despite its title, the report offers a general investigation of the probability of failure of a protective system, in terms of the effects of duplication of sensing and other protective equipment. It is obtainable from HMSO, price 2s 6d, under reference number AHSB (S) R 23.

Prospect for generation

BRITISH ASSOCIATION HEARS OF UNCONVENTIONAL METHODS

TEMPERATURE, and its effect on metals, as a barrier to obtaining improved thermal efficiency of generating plant was the underlying theme of the paper on "Practical Considerations," presented by Mr F. H. S. Brown, C.B.E., deputy chairman, CEGB, to the British Association. The paper was one of the five dealing with unconventional methods of energy conversion, with the emphasis on thermal to electric conversion.

In his paper, Mr Brown reminded the audience that the limit on thermal efficiency of heat engines had been stated many years ago by Carnot as being $(1-T_f/T_i)$, where T_i was the initial cycle temperature and T_f the final or heat rejection temperature. It was thermodynamically attractive to improve efficiency by narrowing the temperature gap between T_i and T_f. This entailed raising the final temperature of heat rejection, T_f, and utilising the rejected heat. In practice, such a method of improving thermal efficiency was fraught with difficulties and ambient temperature was the only practical temperature for heat rejection. In practice, then, increasing the initial temperature T_i of the cycle was the only way to obtain room to manoeuvre for an improvement in thermal efficiency.

Combustion Temperature Not Used

Combustion of most fuels in air at near atmospheric pressure produced heat at temperatures around 1,700°C, but metals were not available which could continuously withstand so high a temperature. For large heat engines working, for example, on the Rankine steam cycle almost universally employed for electricity supply, temperatures were limited to 600°C, although on some large experimental installations this limit had been raised to 650°C. Only in relatively small components with limited life, for example aircraft gas-turbines, could the temperature be raised even to 800°C.

In the internal combustion engine, high temperatures were utilised, with consequent high efficiency, by the "trick" of evolving the heat of combustion at very nearly the peak possible temperature, but then immediately degrading it by adiabatic expansion. In this way, high thermal efficiencies were attained without subjecting working parts to excessive temperatures continuously. However, the internal combustion engine was subject to practical limitations of size and such considerations as noise, wear, vibration and mechanical complexity. As Mr Brown put it: "Things which go up and down cannot be scaled up as easily or as elegantly as things which go round and round." The steam turbine, on the other hand, was an elegant machine in the sense that it enabled economies given by size to be exploited. It scaled up very practically as a mechanical unit and in so doing it became adaptable to steam conditions giving higher thermal efficiency. The accompanying boiler did not have the same merits but it also was capable of being scaled up, and the combined boiler/turbine unit gave a double economy when increased in size, partly because of fall in manufacturing costs/unit output and partly through optimum deployment of more advanced steam conditions accompanying the increase in size. Modern development of the Rankine reheat cycle had led to an intensely practical and comparatively cheap machine, even though inevitably about 60% of the heat was wasted. Mr Brown emphasised that thermal efficiency, with the implied saving in fuel costs, while of great importance, must remain secondary to overall cost and, in generating plant, it was useless to obtain thermal efficiency uneconomically.

The Rankine and Field Cycles

The Rankine cycle had many virtues even, contrary to some opinion, its high latent heat. It was now possible to design plants with sent out thermal efficiencies around 38% by using reheat and the advances in materials and welding techniques which had been achieved. However, there seemed little immediate hope of really significant increases in efficiency. Supercritical pressures, introduction of double reheat and refinements in the feed train—including that very significant user of power, the boiler feed pump—all gave small improvements in efficiency but at the price of additional complication and cost.

The Rankine cycle was not, Mr Brown said, the only possible cycle utilising steam, and for some time the CEGB had been conducting practical research on the Field cycle. In this cycle, superheated steam was used in a gas turbine system operating over a temperature range above about 550°C where the Rankine cycle becomes less and less effective. Superheated steam did work in a gas-turbine. The turbine exhaust steam had sufficient heat extracted to reduce it to the wet condition, partly in a heat exchanger and partly by spray desuperheating. The wet steam then entered a compressor, where it was restored to full pressure for readmission to superheater and turbine. An externally fired superheater was needed for the cycle and a spray desuperheater.

If successful, the Field cycle would permit a reduction in stresses caused by high pressures and would also avoid a large intake of heat in the liquid phase. However, a disadvantage was that it also required certain working parts to operate continuously at peak cycle temperature.

Gas-turbine Boiler Cycle

The reduction in pressure obtainable with the Field cycle was also a characteristic of the orthodox gas-turbine. The resulting relatively low stresses in many parts of the machine gave some advantages over steam cycles, but more power was required to compress the working medium and it was more difficult to carry out compression efficiently in the gaseous phase than in the liquid phase. Even if metal creep with attendant shortening of life was allowed for, the gas-turbine still required a degradation of cycle temperature to about 1,000°C below flame temperature. This degradation was usually achieved by using considerable combustion excess air with consequently little

thermodynamic advantage over the steam cycle where the corresponding process was to introduce large thermal gradients in the heat transmission surfaces. The concept of a combined gas-turbine cycle was attractive because the low pressure ratios used in the gas-turbine, the large volumes of excess air and the consequent high rejection of sensible heat made it practicable to use the gas-turbine exhaust as combustion air in the steam cycle boiler. However from the cost point of view it had not yet proved attractive. Thermodynamically, too, such cycles only attempted to regain some of the waste heat involved by degrading the peak cycle temperature by excess air and, therefore, they did nothing to lessen the fundamental loss of efficiency imposed by this degradation.

High Temperature Materials Unlikely

Fundamentally, the need was to increase cycle temperatures and Mr Brown indicated three ways in which this might be possible: a more elegant use of the intermittent technique, exemplified by the internal combustion engine, evolution of materials able to withstand high temperatures continuously, or a method of employing high temperatures continuously without inflicting them on stressed working parts. Improved materials, Mr Brown considered, were unlikely to be developed capable of working at the higher cycle temperatures of hundreds, or even thousands, of degrees needed. A material which had the virtue of being workable at high temperatures could hardly avoid losing strength at a temperature much below its softening temperature although non-metallic substances, such as ceramics, might help in the development of a material capable of withstanding flame temperatures. In the speaker's view, the remaining possibilities, exploitation of the intermittent technique or continuous high temperature operation without exposing stressed working parts to the high temperature, were the most promising lines of inquiry.

Solar and Nuclear Energy

General physical principles of unconventional methods of electricity generation were discussed in the paper by Prof T. G. Cowling, F.R.S., of Leeds University. He said that virtually all conventional sources of energy depended on solar energy or nuclear fission. The only additional sources available for unconventional conversion appeared to be direct utilisation of solar energy and nuclear fusion.

The availability of a source of energy was, he said, just as important as the fact that it existed. Hydroelectric power, for example, depended on a cycle in which 1% or 2% of the sun's heat was used in vaporising water at sea level. Probably only 1% of the evaporated water was available as a precipitation where it could be usefully employed. At a height exceeding 1 km its potential energy was about 2 cal/gm, compared with the 500 cal/gm needed for evaporation. Hydroelectricity was, therefore, shockingly inefficient if it was regarded as an attempt to harness solar energy, but it was relatively easy to obtain.

At the outer limits of the atmosphere, solar energy amounted to only about 1·4 kW/sq m, so that, for substantial electricity generation, concentration of the arriving energy was essential and, in general, it could be said that solar radiation did not satisfy the criterion of availability.

Solar energy derived from a fusion reaction at a temperature of 15,000,000°K and on a time scale of the order of 10^{10} years. The normal fusion reaction with hydrogen was much too slow for terrestrial energy generation, but with heavy hydrogen it was a good deal faster. Even so, it required a temperature of 10^{8}°K. In such devices as ZETA, an attempt to attain such high temperatures was made by confining the hydrogen in a magnetic field. However, energy losses by radiation and instability usually limited the time for which the gases could be maintained steady to a few milliseconds. Clearly, the fusion reaction also did not satisfy the criterion of availability even though, as Prof Cowling remarked, tremendous amounts of energy (in both senses of the word) had been spent trying to make the energy available.

For large-scale generation, a process needed to be moderately efficient and also fairly simple. Such processes normally depended on effects inside, or at the boundaries between, electrical conductors, which includes ionised gases. Effects at metallic boundaries included thermoelectric generation, and at boundaries between metals and plasma, thermionic and magnetohydrodynamic generation. Generation effects concerned with metals were well known and it seemed that new effects would most likely be found with ionised gases and semiconductors.

In discussing ionised gases, Prof Cowling said that some of the unexpected types of plasma behaviour in experiments might encourage belief that with plasma anything was possible. In fact, as he later showed, thermoelectric generation processes involving ionised gases were in accordance with the laws of thermodynamics and, like the conventional heat engine, devices using them were restricted by the Carnot cycle efficiency.

Thermonuclear Devices and M.H.D.

Thermonuclear devices were likely to be subject to just as serious difficulties in utilising energy as in making it available for use and, although the advantages of nuclear fusion as an almost inexhaustible source of energy were very great, immense effort would be needed to overcome the difficulties of utilisation and, at present, these difficulties were nowhere near being overcome.

In the m.h.d. open cycle, ionised gases were used at a much lower temperature than in the fusion cycle, about 2,000°K. After heating to a higher temperature, the gas flowed through a nozzle, acquiring kinetic energy by adiabatic expansion. The rapidly moving jet then entered a magnetic field, where its constituent ions and electrons were deflected in opposite directions. In consequence, an electric current flowed in the gas, which could be tapped by electrodes. The energy of this current was obtained from the kinetic energy of the gas. Therefore, for maxi-

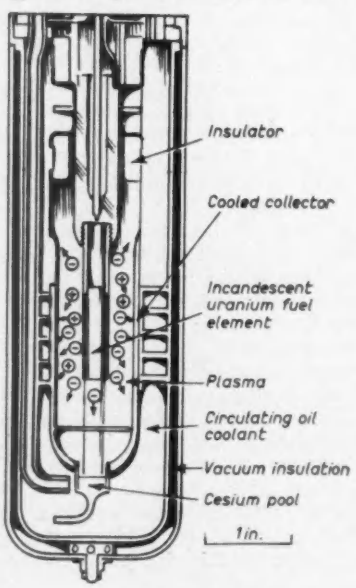


Fig. 1. Diagram of in-pile diode, operated in a Los Alamos nuclear reactor for thermionic generation. The diode uses a uranium carbide, zirconium carbide solid solution cylindrical fuel element neutralised by the spontaneous ionisation of cesium vapour

mum efficiency, all the kinetic energy had to be converted into the energy of the currents, but in practice the difficulty was of obtaining a gas with sufficient conductivity to ensure that the kinetic energy would be given up. If it were not for this difficulty, the energy of the process could be just as well obtained directly by cutting out the expansion before the magnetic field was reached and allowing the gas to expand directly across the magnetic field.

Prof Cowling concluded by referring to the theoretically possible, but practically doubtful, utilisation of the thermoelectric effect by using different ionised gases as the conductors and also to a thermocouple using a metal as one conductor and ionised gas as the other.

Thermionic and Thermoelectric Generation

Thermionic generators as a source of power were considered in a paper by Mr P. D. Dunn. The generator, in which electrons were emitted from a heated filament in an evacuated envelope, was suitable for energy conversion at high temperatures. Small generators with a few watts output had been built for special applications, notably for use in satellites, but for large-scale operation, using fuels such as p.f. or oil, the achievement of adequate heat transfer rates set severe design problems. A nuclear heat source was much better, and in-pile generators using a uranium carbide-zirconium carbide solid solution fuel element had been developed in the US. Generators of this type, acting as "toppers," could be developed for nuclear station reactors achieving efficiencies of 15% or higher, which would add to the normal station efficiency.

The possibilities for using the voltage derived from two different metals in contact if their junctions were maintained at different temperatures, that is the Seebeck effect, were examined in a paper on "Thermoelectric Generation," by Prof D. A. Wright. The only useful application up to the present had, of course, been for thermocouples. However, investigations as long ago as 1930 had shown that conversion efficiencies of at least 5% should be obtainable by using semiconductors, whereas metals gave only about 1%. Improvements have been made with various materials, but there were many difficulties and limitations. An important limitation was that the semiconductor had to be of the "n" or "p" type but, as temperatures were raised, all semiconductors tended to become a combination of "n" and "p" types. This factor limited the operating temperature of one otherwise favourable material to 600°C. With temperatures of 0°C to 500°C such a thermoelectric device would have an efficiency of about 12%. If the device was heated by burning conventional fuels, much of this heat would escape and so reduce efficiency. The best possible efficiency which was foreseeable at present with all the practical difficulties overcome was 17%. To obtain such efficiency would require a cascade arrangement operating over a temperature range of 0°C to 1,200°C, in which heat rejected from a higher stage temperature would be used to heat a lower stage.

Fuel Cells

The fuel cell was inherently a very efficient means of converting chemical energy in a fuel into electrical energy, and cells have been built with overall thermal efficiencies of between 70% and 80%. In the paper presented to the engineering section by K. R. Williams, of Shell Research, some of the engineering problems which have to be overcome, and possible fruitful lines for their solution, were discussed, for both normal and high temperatures.

The fuel cell was able to operate at high efficiency, but to be suitable for widespread application it also had to be cheap, light, compact and it must use a cheap fuel.

If traction possibilities of the cell were considered to have a power-to-weight ratio comparable with a diesel engine and gearbox, a fuel cell and motor unit would need to yield a peak output current density of at least 200 mA/cm². For the hydrogen-air and hydrogen-oxygen cells, current densities of this order could be approached now but, to achieve this performance, considerable development was necessary to ensure adequate heat removal from the cell by circulation of the electrolyte. Another problem was removal of water produced by the reaction from the cell electrodes. This would best be done by the current of air passing the air electrode of the cell, but not all suitable electrode materials were of the type from which water could be removed. One solution, developed in America, was to replace the liquid electrolyte by an acid ion-exchange membrane with electrodes either side. Water formed by the reaction was rejected by the membrane and ran off it. However, under conditions of low humidity too much water might be removed, and this further problem was overcome by feeding water to the appropriate electrode faces. Another problem was to ensure that the considerable volumes of gases used were uniformly distributed over the active surfaces. When the cell was operating, water might block some gas channels and if this occurred the cell reverted to an electrolytic cell. This meant that the loss of two cells by duct blockage was equivalent to four cells being removed from the battery.

Further problems arose if a more satisfactory fuel than hydrogen gas was sought. Liquid fuels, such as methanol or a hydrocarbon fuel, were attractive and cells had been made using them but, unfortunately, their efficiency (20% to 30%) was, at present, low. They were further complicated by poisoning of the catalysts used and ingenious engineering would be needed to overcome these problems and reduce the bulkiness of this type of cell.

As an alternative to the low temperature fuel cell, fuel cells operating at up to 700°C had some apparent attractions. A non-aqueous electrolyte could be used and, in consequence, there was no water removal problem and contamination of the catalyst was less likely. However, such cells, using carbonaceous fuels such as propane, could only operate for a short time before they became sooted up. The high temperature fuel cell operation was further complicated because the electrolyte did not conduct until its temperature was above 500°C and, of course, materials which would withstand such high temperatures were required for the cell construction.

Although many problems remained to be overcome before fuel cells could become competitive with other forms of power, already there were types capable of meeting military requirements which could not be met by other sources of power. In the future, when fossil fuels were nearing exhaustion, synthetic fuels might be developed which would make the fuel cell a better commercial proposition.

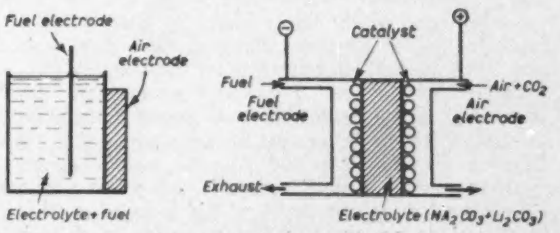


Fig. 2. Diagrams of fuel cells. Left, "liquid" fuel cell. Right, high temperature fuel cell

AROUND THE TRADE

BY PEREGRIN

ONE bright spot in an otherwise dull August was the Radio Show at Earls Court and particularly the separate exhibition by the GEC at the Horticultural Hall. It was intriguing to see several competitive makes of radio and television all together under the benevolent GEC umbrella. There was also a considerable display of electrical domestic appliances on show which helped to make the visit worth while. I always feel a certain amount of envy and dismay that the electrical appliance manufacturers seem incapable of making such an effort on their own behalf as the Radio Exhibition. Could they not get together with the radio manufacturers for a first-class combined show? I will warrant it would be well attended. I felt this time that the radio manufacturers were having difficulty in presenting something new to attract the public. There is so little that can be done to glamorise the baleful one-eyed opal blob that haunts the corner of most drawing rooms. Some had apparently anticipated the Common Market with what one of my friends described as "built-in balconies" with an eye, perhaps, on sales in Italy; and practically all had neglected completely the customer who prefers traditional cabinet work to a box on stilts. Of course, what the industry is really needing is the shot in the arm that colour television would give. Still, what the sets lacked in attraction was made up by the displays themselves—some of them were terrific—so much so that in some cases the goods were eclipsed by the brilliance of the stand layout.

Price Maintenance

I took the opportunity of sounding one or two of the manufacturers on the question of price maintenance and, as I expected, found all in favour. Why, then, do they not gird up their loins and do battle together? In a recent broadcast on the cut price versus price maintenance battle, the cut price advocate was given a terrific boost by the BBC, yet neither BEAMA, RTRA nor NECTA do anything about it. Surely, more publicity could be given to matters like expert advice, selective display, sound installation, efficient after-sales service and, most important of all, maintained quality of the goods. I would suggest that now is the time to get together and work out their common problems and devise the soundest means of getting their ideas over to the public. Of course, it may be difficult for a manufacturer to talk of price maintenance when the GEC's eloquent Nicholas Stacey extols the supermarkets and price cutting, and the benefits of supermarkets over the ordinary retailers. I see it is reported that, in his usual charming fashion, he pointed out to a women's gathering their shortcomings in not planning their purchasing sprees. I would have thought that as a married man Mr Stacey would know more of women. I feel he is viewing women's purchasing habits from the wrong seats, and that six months behind a retail counter in a small personal store might add considerable width to the depth of his knowledge. Women in general do not want to buy according to plan—it is foreign to their nature—but the most ordinary of women can be amazingly shrewd when she wants to be. Also, many women still prefer the friendly advice of the personal shopkeeper and most certainly so when they are buying other than consumable commodities. There still exists the type of shopper who dislikes the atmosphere of the supermarkets and, having no car, appreciates someone who will deliver to suit her convenience rather than "Friday week when the van covers your route." And there must be thousands of women living alone who dare not buy electrical or radio equipment without advice, personal assurance, delivery, installation and service. Of course, in Mr Nicholas Stacey's world everything must be viewed through the telescope of "economics" and reduced to the common denominator of finance. Indeed, the world is ruled by finance, but whether one should recommend it as the be-all and end-all of the harassed housewife I have my doubts. My kitchen comptroller muddles happily through her shopping and produces an impression of plenty in an atmosphere of peace without too much drain on my substance.

Maintenance and Service

Mr Stacey has also dealt with maintenance and service. He should, perhaps, divide it under two headings—repairs under guarantee and repairs after the guarantee period is ended. The first would be replacement of parts by the manufacturer and would include also his time or would otherwise be fitting the replacement parts by the retailer at no charge. The incidental costs of packing, postage and retailers' time under this heading is no negligible item over the years, as most retailers would confirm. The second heading would cover maintenance or service on either a time and material basis or on the basis of an annual fee. Mr Stacey should know that many retailers are equipped to give excellent service to every type of equipment, as also are many manufacturers and wholesalers, although some are only able to service smaller items such as irons and kettles. Often the retailer is hampered in his service to the public by the length of time he has to wait for replacement parts or even for the manufacturer to complete a repair sent to him. This also covers such repairs as washing machines, vacuum cleaners, etc., in the customer's own home. Mr Stacey visualises a completely new set up, a scheme of national coverage; but I suspect this somewhat grandiose scheme would only work if the user could be persuaded to pay about double the charges of a good local servicing retailer to meet the high administration costs. I believe the best scheme of all is that which is even now being put to work by the NECTA retailers, where those retailers not equipped with the necessary know-how, or laid out for service, can make arrangements with the retailer who is, to carry out that service for him at no extra cost to the user. A very fair set of working principles has been drawn up to operate the scheme, which should provide a successful, efficient and economical service throughout the country. As I mentioned in my August notes, it is already running very successfully on several makes of shavers and on Sunbeam appliances.

Electrical aids to research

INVESTIGATIONS ON BEARINGS AND WATER TURBINES

THE importance of electrical and electronics ancillary techniques as an aid to mechanical development is well illustrated by the annual report for 1960 of the National Engineering Laboratory at East Kilbride.*

An electro-optic servo system has been successfully applied to the control of a gear hobbing machine to enable gears of exceptionally high precision to be made. Spark machining has been applied to form holes in gas-turbine blades for research on cooling the blades by fluid.

Prolonging Bearing Life

One of the early findings in a long-term investigation on the reduction of ball bearing life by premature pitting of the balls showed that 5% of water present in a mineral oil would reduce by half, the life of the balls made from conventional steel.

Investigations have now shown that the addition of commercial iso-amyl alcohol counteracts the effects of water in lubricant. Improved life was also obtained with two commercial de-watering agents, but two surface-active materials, one of which was oleic acid, had practically no effect on life. The tests were made with lubricant conditions ranging from extreme dryness to supersaturation. Electron microscope examination of the wear track was used to determine the effects of running with water and additives.

As a result of industrial reports that indifferent improvement in performance had unexpectedly been obtained when using molybdenum disulphide as a lubricant additive, tests were made to assess whether this poor result was due to other additives in the lubricant concerned. Molybdenum disulphide is only effective as a lubricant if it can be bonded to the bearing surfaces. Results of the tests showed that the presence of surface-active agents, such as oleic acid, were detrimental to the formation of this bond since they repel the molybdenum disulphide by forming their own monolayer on the bearing surface. This trouble does not occur with alkali-based additives which are compatible with molybdenum disulphide.

Contact Film Thickness

Measurement of contact resistance was used in investigating another lubrication problem. Hypoid gears as used in road vehicles are subject to extremely high contact pressures which may cause scuffing, or other damage, if an incorrect lubricant is used. Tests have been made at the laboratory on gears at speeds equivalent to 60 m.p.h. and at temperatures up to 100°C. The pinion under test was electrically insulated from its mounting and contact made with it through graphite brushes. The contact resistance between meshing teeth was measured and this indicated the presence or absence of a lubricating film. Such gears are frequently subjected to peak temperatures up to 700°C. To simulate the effect of such high temperatures on the lubricant, pulses of electricity were passed through metal wires inserted in paraffin containing sulphur compounds labelled with radioactive isotopes. The radioactivity of the wires after the test gave an indication of the thickness of deposit formed by the discharge and therefore by the high temperature.

Water Flow Measurement

The laboratory now offers advice and service in the field for the measurement of large water flows. One application of this service is determination of the efficiency of hydro-electric turbines which requires that the water flow be known precisely. Three methods of flow measurement have been developed. In one, the passage of a cloud of common salt between two electrodes is timed. The salt is injected into the water flow as a narrow cloud by an explosive cartridge, and portable electronic equipment has been designed to detect the presence of the salt cloud and for timing the cloud movement, so enabling the results of flow measurement tests to be available almost immediately in contrast with hours' or days' delay using previous methods. In the second method, a known concentration of salt solution is injected into the flow to be measured. The rate of flow is then found from the known injection rate and the relative concentrations measured downstream of the injection point. The third system uses current meters and equipment has been developed at the laboratory for electronic monitoring of 20 such meters. Tests have been made at Kinlocheven and Finlarig hydro stations and in Switzerland, where it was possible to confirm accuracy of measurement as being within 1%.

Another aspect of the Laboratory's work has been the investigation of how reliable are models of water pumps and turbines, tested in air as the working fluid, for the design of the full size machines. Although such tests have only limited application, results on a pump and on a model Francis turbine have shown good agreement with water tests.

During the year the Laboratory's rig for testing water-turbine models was used to investigate a Francis turbine with alternative runners having 17 blades or 13 blades. The test apparatus which includes a digital data logging system, was used for runaway, efficiency, and cavitation assessment.

Another development during the year was a liquid level detector capable of detecting liquid to within 0·01 in. of a predetermined level. The detector functions because the critical angle of reflection for Perspex changes from 42° to 45° if it is measured in air and then in the liquid. This change in angle is sufficient to cut off light reflected on to a phototransistor.

Noise Measurements on Motors

The Laboratory is well equipped with noise measuring equipment and one investigation undertaken during the year was a series of tests on small electric motors. These tests showed that a simple instrument, in which the noise level in one octave band was measured, could be devised for routine testing of electric motor noise levels.

* National Engineering Laboratory, Annual Report, 1960, HM Stationery Office, Edinburgh. Price 5s.

Personalities *in the industry*

Mr D. S. Reid

Mr R. E. Milledge

Mr G. E. Johnson

Mr W. K. McCandlish

Mr D. J. Wellington

The appointment of three directors of Radio and Allied Holdings Ltd. is announced by the GEC. They are **Mr T. C. Standeven** (who also becomes general manager), **Mr R. H. Pengelly** and **Mr K. Veseley.** In addition, **Mr P. R. Sanson** becomes a director of GEC (Radio and TV) Holdings Ltd.

From Epsylon Industries Ltd. (one of the Stone-Platt group) we learn that **Mr C. Garn** has been promoted to sales manager, and **Mr R. A. Edwards** has joined the company as works manager. Mr Garn joined Epsylon in June, 1960, as chief sales engineer for magnetic tape recording equipment. Mr Edwards was previously production manager of Decca Radar.

With the growing expansion and diversification of the Morphy-Richards group, it has been decided to have an independent sales force for the "Astral" refrigerators and spin dryers, and a separate "Cray" sales force for the rotary ironers, vacuum cleaners and smaller appliances. In this reorganisation the original group sales force has been divided basically into the two new sales Divisions, with 17 "Cray" representatives and ten "Astral" sales representatives. For Morphy-Richards (Astral) Ltd. there are now three regional sales managers for the three major regions—North, Midlands and South. **Mr D. S. Reid,** previously M-R group Scottish area manager, is the North Region Astral sales manager. The region includes Scotland and N England, and Mr Reid will operate from 116 West Campbell Street, Glasgow. The Midlands Region Astral manager is **Mr R. E. Milledge** who was previously the group's Midlands area manager. His territory includes North Wales and Yorkshire, and he will operate from Ronlyn, Church Rd, Snitterfield, near Stratford-on-Avon. **Mr G. E. Johnson,** previously group area manager for SW England and South Wales, becomes South Region Astral sales manager, with territory including London, East Anglia, the Home Counties and South Wales, in addition to the whole of South England. He will be based at 50 Conduit St, London W.1. As a result of the reorganisation two new area managers have been appointed for Morphy-Richards (Cray) Ltd. **Mr W. K. McCandlish,** previously group senior representative in Scotland, is promoted to Scottish area manager, operating from 240 Darnley St, Pollokshields, Glasgow, and **Mr D. J. Wellington,** formerly group senior representative for Yorkshire, becomes Yorkshire and North East England area manager for Morphy Richards (Cray). He will operate from 7/15 Whitehorse St, Boar La, Leeds.

Previously Scottish area manager, **Mr R. M. Wardrop** has now been placed in charge of home sales of the Instrument Division of Evershed and Vignoles Ltd. as part of the reorganisation of that division.

Formerly deputy manager of the AEI London regional office, **Mr H. M. Hawkswood** retired recently after 37 years' service in the group, commencing with Ferguson Pailin Ltd. He transferred to the latter's London office in 1927 and by 1942 he had become manager there. In 1955 he was appointed a director, with special interest in export sales. Subsequently when Ferguson Pailin integrated within the AEI organisation he became deputy manager of the London regional office.

Mr G. Nuttall has been appointed sub-area accountant of the No. 7 (Grimsby) sub-area of the Yorkshire Electricity Board, to succeed **Mr H. Bagshaw,** A.I.M.T.A., recently appointed sub-area accountant at Sheffield (*ESH, pages 144-6). Mr Nuttall has served in the Accountancy Branch of the electricity supply industry since 1931, and since 1951 has been principal assistant (accountancy) in the Board's No. 7 sub-area. At Sheffield **Mr H. Bagshaw** succeeds the late Mr R. Longley. He was formerly sub-area accountant in the Board's Grimsby sub-area, and prior to going to Grimsby in 1950 served in the Bradford sub-area and with various local authorities.

The MCB Co. (Manchester) Ltd. have appointed **Mr S. T. Gregory** to represent the company in South Wales and the south-west. For the past 12 years Mr Gregory has represented George H. Scholes and Co. Ltd. and was previously with the BTH Co. at the Cardiff office.

We are now informed by the GEC Installation Equipment Group that the qualifications of **Mr E. G. Taylor** (on wholesale liaison duties) were wrongly given in the information published on 31 Aug. They are: B.SC.(ENG.), M.I.E.E. In addition, with the IEE Benevolent Fund he is local honorary treasurer.

Mr F. Winston Reynolds, founder of Winston Electronics, has relinquished his duties as chairman and managing director of the company, and will now devote the whole of his time to the exploitation of their new range of fully transistorised loudspeaking telephones. **Mr W. Allen Bridges** has taken over as chairman and managing director. Mr Bridges, who is the director of European operations of the Dynamics Corporation of America, of which Winston Electronics is a wholly owned subsidiary, is permanently resident in Britain. Mr Reynolds remains a director of the company.

Mr G. Gardner, who has been sales representative to Rowlands Electrical Accessories Ltd. in the north western

**Denotes revision to the "Electricity Supply Handbook, 1961."*

area, has now been appointed to succeed the late Mr J. L. Hill in the London area. The new sales representative in the north western area is **Mr E. W. Bailey.**

Formerly area manager with Chrysler Airtemp Ltd., **Mr K. H. Bourne** has joined J. Raven Ltd., London distributors of Chrysler Airtemp air conditioning and refrigeration equipment, as applications manager. Mr Bourne graduated as a mechanical engineer at Guildford Technical College, and from 1956 to 1958 was with a firm of design consultants as a design engineer concerned principally with aircraft air conditioning systems. He joined Alfred Porter Ltd. in 1958 as applications engineer, and from 1959 until joining Chrysler last January he was senior design engineer with Carrier Engineering Co. Ltd., engaged on design and applications of refrigeration systems for air conditioning.

Mr K. G. Huntley has been appointed chief electronics engineer to Adrema Ltd. He will be responsible for the formation and building up of the new Data Processing Division to be centred at the firm's new factory at Cosham, Portsmouth. Mr Huntley served EMI Research Laboratories for nine years, and in 1956 he joined Rank Precision Industries, being responsible for the electronic development undertaken.

Appointed as technical sales manager of Ekco Heating and Electrical Ltd. is **Mr J. C. Longman,** who joined the company as heating technical representative in 1950, covering the Eastern Counties and North London. Two years later he became responsible for technical sales liaison with government departments, electricity boards and public authorities.

Atlas Lighting Ltd. announce the appointment of **Mr J. E. Wooldridge** as sales supervisor for their south western area. He joined Atlas in November, 1960, and moved from Nottingham to Cardiff last February.

The Minister of Fuel and Power has reappointed **Sir Giles Loder,** BT., M.A., J.P., as a part-time member of the South Eastern Electricity Board.

Mr H. E. Bagnall, of Edmundsons (Midlands) Ltd. has been appointed director and general manager of that company. He was previously a director of F. Westerman (Wholesale) Ltd., a company which joined the Edmundsons group in 1957.

For the past two years personal assistant to Mr W. K. Brasher, secretary of the Institution of Electrical Engineers, **Mr P. D. G. Heneker** has now been appointed the Institution's first public relations officer, in the London headquarters staff. Mr Heneker, aged 30, was educated at Wellington College and Brasenose College, Oxford. He joined the IEE staff in 1958 after spending four years with a British business house in Calcutta.

Mr B. F. W. Hayward, D.F.H., A.M.I.E.E., A.M.A.I.E.E., electrical and resins sales manager to Midland Silicones Ltd., leaves Britain on 16 Sept. on a seven-week business tour of South Africa, Australia and India, during which he will also give seven lectures.

Several new appointments have been announced by Associated Electrical Industries Ltd. **Mr P. V. Lister** becomes assistant to **Mr J. W. Ridgeway,** commercial director of AEI (Woolwich) Ltd. Mr Lister joined the Edison Swan Electric Co. in 1949 as assistant to the manager of the Central Order Department. Two years later he took charge of the company's Sales Planning Department. In 1959, after the merger to form Siemens Edison Swan Ltd., he became responsible for sales of valves and c.r.t.'s to television and radio set makers. In January, 1960, when AEI was reorganised and a Divisional structure introduced, he became sales manager of AEI Radio and Electronic Components Division and subsequently was appointed commercial manager of the Division. Mr Lister succeeds **Mr E. M. Whitaker** as assistant to the commercial director.

In the Electrical Plant Department, **Mr R. Meikle,** B.SC., DIP.R.T.C., has been appointed assistant superintendent, Large Electrical Plant Department at the Trafford Park works of AEI (Manchester) Ltd. Mr Meikle was educated at Hamilton Academy and took his degree at the Royal Technical College, Glasgow. After commissioned service in the REME he joined the BTH Co. at Rugby as a graduate apprentice, and subsequently became a management trainee, serving in the Insulation and Turbine Winding Departments on the supervisory factory staff until 1955. During this period he was awarded a BTH Fellowship and spent a year in France with the Alsthom company. In November, 1955, he joined the Works Engineering Department for development work in the new factory at Larne, where, in 1956, he became assistant superintendent of electrical assemblies.

Mr A. Roxburgh, A.M.I.E.E., has been appointed Divisional assistant chief engineer (design) of the AEI Switchgear Division. Educated at the Borough Polytechnic, Mr Roxburgh served his apprenticeship with the BTH Co., and in 1947 was appointed circuit-breaker designer. He was promoted to development engineer in 1953 and to chief engineer of the Willesden works in 1959.

OBITUARY

Mr H. Etchells, who was area manager at Manchester to AEI Lamp and Lighting Co. until retiring late in 1960, has died, aged 66. He had also been local secretary of the EIBA, and treasurer of the Illuminating Engineering Society, Manchester centre, for 13 years.

Mr J. H. Blackmore, ASSOCIATE I.E.E., Kent sub-area engineer to the South Eastern Electricity Board since 1948, died on 6 Sept., aged 54 (*ESH, page 88). He had spent all his business life in Kent. He served an apprenticeship with the Kent Electric Power Co. and subsequently held a number of appointments in that organisation, culminating in his appointment in 1943 as regional mains engineer.

Mr K. G. Huntley

Mr J. C. Longman

Mr J. E. Wooldridge

London Transport Expansion

THE annual report of the London Transport for 1960, published by the LTE at 2s 6d, records a slight increase in rail passengers by 0·8% to 674 million, but a decrease of 4·6% to 3,267 million in the total number of passengers, due to a fall in bus service patronage.

On the Underground, electrification of the Metropolitan line to Amersham and Chesham was completed and further planning work carried out on the Victoria line. Trolleybuses now remain on only a few routes and work began during the year on conversion of a 25 c/s turbo-alternator at Greenwich, previously used for the bus service, to 50 c/s operation. Modernisation of substations is also reported with the replacement of rotary converters, some more than 50 years old, by rectifier plant.

NEW LITERATURE

Welding Engineers' Handbook

by J. A. Oates, C.INST.W.

FOR many years the *Welding Engineers' Pocket Book,* which has run through eight editions, has been the popular guide to all who are concerned with the practices of welding. Now the time has come when the pocket book, in its original format, is no longer large enough to encompass the many developments which have taken place since it first appeared. As a result, it has been completely revised and brought up-to-date in larger format with the title revised to suit.

Some of the latest advances, particularly in the field of shielded arc welding, are incorporated and another innovation which will be much appreciated is the directory of welding rods in Section 18. Electric welding in all its forms is, of course, well featured but the lesser used methods such as "Thermit," percussion, finewire, electron bombardment, etc., are also given mention. A most useful and practical reference book which should also see many editions. Published by George Newnes, 290 pages 7¼ in. by 4¾ in. Price 21s.

Battery Traction on Tramways and Railways

by T. Illingworth

A SHORT outline of the history of electric traction on tramways and railways dealing mainly with European systems. Reference is made to the Drumm installation in Ireland and the recent BR service in Scotland. Mention is also made of locomotives powered by batteries for power stations use and for maintenance purposes. Published by The Oakwood Press, 23 pages, 8 in. by 5 in., price 5s.

Lead Alloys for Cable Sheathing

by S. A. Hiscock, M.SC.(LON.), D.C.T.(BATT.), A.I.M.

WRITTEN for the cable specialist, this book is unique in being, according to the author's preface, the first of its kind devoted exclusively to cable sheathing using lead and its alloys. Whether or not this claim is justified, the book will doubtless be welcomed in view of the vital part still played by lead-covered cables in both power distribution and telecommunications. The book opens with a review of historical aspects of cable sheathing, followed by a survey of various lead extrusion presses and machines which have been developed for the purpose. Chapters then deal with various lead alloys employed for sheathing with important sections of the book devoted to defects occurring in cable sheaths and the effects of extrusion techniques on quality. Strictly metallurgical in character, a chapter is included which discusses the interrelation of variables in the extrusion process. Appendices include an outline of special requirements of sheath design for the Mollerhoj flat section cable, plus analyses and fatigue data for commercial lead alloys. The extensive bibliography lists 260 references. Published by Ernest Benn Ltd., 361 pages, 6 in. by 9in. Price 70s.

British Miniature Electronic Components and Assemblies Data Annual 1961-2

edited by G. W. A. Dummer and J. Mackenzie Robertson

THIS book, which is the first in a new annual series, contains concise technical details on miniature components, information on the effects of potting resins, nuclear radiation, temperature, vibration and other factors. For the purposes of this annual, miniature components are considered as being smaller than a 1 in. cube. About 200 pages are occupied by details of fixed and variable resistors and capacitors, but many other items including printed circuit assemblies, timers, solar cells, and plugs and sockets are covered. The components listed are British manufactured or assembled only, as separate editions are proposed for European and American items. Transistors are not included. The annual is profusely illustrated with line diagrams, dimensioned drawings and performance characteristic graphs. Published by Pergamon Press, 479 pages, 11 in. by 8½ in. Price 80s.

Classified Examples in Electrical Engineering (Vol. 2)

by S. Gordon Monk

THE seventh edition of this useful selection of questions and answers on electrical subjects up to the level of Higher National Certificate has been regrouped and extended to also meet requirements of the new Pt. 3 examinations of the IEE. The fact that it is still in demand after 38 years is its own recommendation. Published by Sir Isaac Pitman and Sons, 295 pages, 7¼ in. by 4¾ in. Price 15s.

Electronics: a Bibliographical Guide

by C. K. Moore, B.SC., *and K. J. Spencer,* A.I.A.

THE task of searching through the welter of published technical works for specific items of information is a major one, but particularly is this true for the electronics engineer, in whose field the number of publications increases daily. This book lists nearly 3,000 text books, survey articles, convention proceedings and papers with a concise summary of their contents. In addition the book is divided into 67 sections with the aim that any paper concerned with electronics can be located. Not the least valuable sections of the book are the introductory pages which list reference media including buyers guides, periodicals, technical foreign dictionaries and translations, and the concluding author and subject indexes. The authors who are with the RRE and the Ministry of Aviation, have produced a most valuable reference source. Published by Macdonald and Co. (Publishers) Ltd., 410 pages, 9¾ in. by 7¼ in. Price 65s.

Lead Cable Sheathing

LEAD has competitors as a cable sheathing material nowadays, but it is still the outstanding material for this application. In the present compact booklet, the Lead Development Association sets out to sketch the essentials of the production, properties and uses of lead cable sheathing. Lead presses are described in outline, and there is a list of the standard cable sheathing alloys. Illustrations are then used to show the typical sheaths in both the power cable and communications cables fields. Published by the Lead Development Association, 34 Berkeley Sq, W.1. 16 pages, 8¼ in. by 5¼ in.

Colour Television

by P. S. Carnt and G. B. Townshend

WITH the current interest in the possibilities of a British colour television channel in the near future, there will be a demand for a comprehensive text book on the principles underlying the design and servicing of colour receivers. This demand has been anticipated in a volume which assumes that any British system will, almost inevitably follow the N.T.S.C. system developed in the U.S.A. and adopted there. It describes, with a wealth of detail but commendably little mathematics, the fundamentals of colour measurement and its breakdown and re-synthesis in TV cameras and receivers. In the later chapters it discusses the shortcomings of present systems. Published by Iliffe Books Ltd., 487 pages, 8¼ in. by 5½ in. 233 illustrations. Price 85s.

BOOKS RECEIVED

Electrical Principles, by H. Cotton. Elementary text-book entirely in terms of MKS system. Third edition, with new chapters on behaviour of a.c. circuits. Published by Chapman and Hall, 423 pages, 7¼ in. by 4¾ in. Price 15s.

High Voltage Distribution Practice, edited by J. W. Grindley. Report of symposium of lectures given by specialists at Regent Street Polytechnic. Published by Ernest Benn, 240 pages, 9 in. by 6 in. Price 45s.

The Omegatron, by P. G. Bentley and J. Leece. Description of special type of mass spectrometer, issued as UKAEA report DEG 327 (CA). 13 pages, obtainable from HMSO, price 4s.

Electric Lighting, by C. E. Gimson. General review of lighting techniques in Cleaver-Hume Electrical Series. Published by Cleaver-Hume, 224 pages, 7¼ in. by 4¾ in. Second edition, price 15s.

Selling electricity in America

CAMPAIGN BACKED BY HEAVY ADVERTISING

SELLING electricity in America where it has to compete with lower-priced natural gas and oil has become the subject of high-powered advertising in an attempt to sell the concept of an all-electric home. To promote electricity in homes the G-E Co. of America started a "Live Better Electrically" campaign in 1955 and carried it on for four years backed by $9 million advertising. The campaign was then taken over by investor-owned companies who carried on the work in conjunction with the Edison Electric Institute.

In the last two-and-a-half years the campaign has made great progress and its work and future were described at the annual convention of the Edison Electric Institute recently by Mr W. M. Shepherd, vice-president, sales, Arkansas Power and Light Co., and chairman of the EEI Live Better Electrically Policy Committee.

Promotional Methods

Promotion of electricity has been brought down to a fine art in the United States, where the supply industry remains an agglomoration of individual public companies, state managed and other government controlled authorities. These bodies have banded together with some companies which are partially connected with the industry to support the campaign and have set up three committees for its administration.

Although it is generally thought in this country that Americans have a greater range of domestic appliances especially kitchen aids than this country—a concept borne out by statistics—cost seems to be a prohibitive factor in sales. One large stumbling block is, of course, the fact that electricity is more expensive than gas or other forms of fuel. The campaign committee are trying to counteract this idea by emphasising advantages of using appliances; for, to one out of three consumers questioned during a survey, high cost was a prohibitive factor. Those who sell electrical appliances have found it necessary to provide a motive, cleanliness and comfort, to combat this cost phobia.

One thing the campaign committee have found is that the average American housewife would like many appliances to ease her housework, but does not wish to appear lazy to her family. Therefore advertising has consequently had to be geared to this idea. Advertisements have been designed to show not that electrical appliances will pamper the housewife but that they will be of great benefit to the family and family life as a whole. On the other hand, the man of the house has to be persuaded that greater outlay for an electrical appliance is worth while as it is good for his wife, himself and children.

Know the Facts

It has been found that the American family requires to know competitive facts before it decides to purchase an appliance. During a survey research was carried out on the popular image derived from the words "electricity" and "gas." Generally it was found that "electricity" meant comfort and luxury, cleanliness and future benefit, but it also meant expense and was a mystery. On the other hand, "gas" conjured up the image of being functionally less efficient but easier to understand ("after all the flame of gas can be seen") it is also old-fashioned, but many housewives preferred it on the grounds that their mothers cooked over gas flames. Gas also has the advantage of being cheaper, a point which constantly crops up and needs to be overcome. However, the conclusion is that there is a total movement towards electricity in the home; even those who use gas for cooking are found to have only slightly fewer electrical appliances than those who cooked with electricity.

To an extent the drive to sell electric living has been advertised in conjunction with housing developments where the houses are all-electric. Combined in the advertisement is reference to "Gold Medallion Homes" which have facilities mainly for electrical appliances for cooking, heating and kitchen aids. The practice is to show a "real-life" family, with names and address supplied, who live in a total-electric "Gold Medallion Home." The rest of the advertisement consists mainly of opinions on electricity and its advantages, expressed by members of the family.

Single Theme Policy

Prime point continually hammered home in these advertisements is the one exclusive benefit of electricity. The word, of course, is "flameless" and this is stressed again and again. From an interview on this theme, three concepts emerge from the one word. Apart from the obvious derivation of no flame—thus differing from gas—it means cleanliness, absence of soot and dirt on kitchen walls, and also is taken to mean safety because of the very fact there is no flame. Having once found the keyword, campaign organisers bombarded prospective consumers with the three themes in one through the medium of advertising. "Real-life" families, stars of the advertisements, talked of the cleanliness of their flameless electric heating, clothes dryers and other appliances. It was found that the safety angle did not need to be emphasised as it was taken as a foregone conclusion.

This method of advertising, which is to an extent being used in this country, is found to be effective in the United States. One advertisement on this theme during 1960, for an electric clothes dryer, was found to be the most widely read appliance advertisement for the previous ten years. Here, again, the word "flameless" set electric clothes dryers apart from all others and hinted at an exclusive benefit which could alone be obtained from using such an appliance.

Few Electric Heaters

Strangely, the idea of electric central heating in houses and also the use of conventional electric heaters has lagged far behind in America, only being accepted on any

scale during the last 12 months. During a research carried out a year ago on this subject, frequent replies were: "What about electric house heating? I've never heard of it?" With this to combat, Live Better Electrically representatives set out to find what persuaded people to buy and live in electrically heated homes and what points about it they favoured most. In nearly every case, the concept of cleanliness was remarked upon voluntarily. Therefore, advertising ideas were focused around this idea and its benefit was put to use in advertisements. As with flamelessness, LBE are intent on selling a concept on electrical living rather than any particular product. To provide advertising material, consumers were questioned as to why they bought electrically heated homes and, equally, why they did not. Thus, the way was paved for advertising policy of future months.

This form of advertising has been found effective, as statistical figures show. In a recent survey, 68% of those interviewed remembered the advertisement on the family theme and of those 57% recollected the sales message.

In the "Gold Medallion Home" advertisements a two-pronged attack is being launched, first at the consumer and secondly at the builder. Space is reserved for the latter to relate why they chose to install electric house-heating and so try to convince other developers of its advantages.

This method of promotion, apart from being utilised in national magazines is also being used by manufacturers and supply undertakings who are advertising the advantages in their own localities. When advertising in national magazines, the LBE policy committee have found that adverts must be sufficiently large in size, to give space for illustrations and interviews.

Future Plans

What of the future? The family line is being pursued to its utmost and attempts are being made to use "real-life" families to promote all electrical appliances instead of just bringing home the concept of living with electricity. Television would also seem to lend itself, but promotional costs could prove too expensive in relation to results and sales.

Materials for Electrical Design

FOIL FOR LAMINATES

A NEW range of printed circuit grade electrodeposited copper foil, coated with a dry thermosetting adhesive film, for manufacturers of copper-clad board used in the production of printed circuits, claims to offer an impressive list of advantages over other foils. The main points are the excellent storage life without deterioration, high bond strength, solder dip resistance and electrical properties, while the dry adhesive enables the finished boards to be processed without the risk, common to liquid adhesives, of the copper becoming detached from the base.

By using the foil at the same time as the baseboards are being processed from the basic resin-coated stock, a blending of the bonding adhesive on the copper with that on the boards take place, irrespective of whether the resins are phenolic or epoxy. The foil is supplied in sheets of dimensions to the customer's requirements. *Fothergill and Harvey Ltd., Littleborough, Lancs.*

TFE RESIN PRICE REDUCED

REDUCTION of 4s/lb in the price of "Teflon" TFE—fluorocarbon resin is announced by the Dupont Co. (UK) Ltd. The new price in 10 lb drums is 34s 9d lb; 35 lb drums 30s 6d. The new prices apply to orders placed on or after 5 Sept.

SELF-LUBRICATING NYLON

A SPECIAL grade of nylon incorporating molybdenum disulphide, the solid lubricant, as a filler, marketed under the trade name of "Nylatron GS" is particularly applicable to situations where high resistance to deformation under load combined with non-fretting, low friction-loss sliding or rolling contact is required. The material, which is available either as moulding compound, bushing stock, rod, strip or plate, is suitable for all bearing surfaces calling for close tolerances, dimensional stability, high operating temperatures and resisting distortion above 300°F, generally in unlubricated areas. Electrical properties are also good as well as its resistive properties to oils, greases, alkalis, acids and organic solvents. *Polypenco Ltd., Tewin Rd, Welwyn, Herts.*

A NEW METHOD OF JOINTING CONDUIT

CONDUIT is often taken into corrosive atmospheres and has to be protected at the joints against ingress of materials which might attack the cable. The conventional method of jointing is to use well-tried compounds which, although perfectly satisfactory, are not the cleanest and easiest materials to apply.

A new method of jointing pipes, metal or plastics, by the use of a thin unsintered p.t.f.e. tape has now been devised. It is convenient, clean and possibly even cheaper than hitherto, since there is no waste of any kind as distinct from conventional compounds which harden off rapidly in their tins. The method is being adopted extensively by the plumbing trade as such and in some circumstances could be used in electrical installations.

The new jointing material is sold as a tape or ribbon usually about ½ in. wide and 0·003 in. to 0·005 in. thick. It is normally supplied on a small spool from which it may be applied directly to the pipe thread. The tape is in the unsintered form. This means that it has not been toughened by heat treatment and is quite soft, thus taking the shape of the thread to which it is applied quite readily.

The tape has all the usual properties of p.t.f.e. These include (to mention those properties likely to be of value from the jointing point of view) complete resistance to nearly all known chemicals, gases and solvents; high and low temperature resistance (−250°F up to 450°F) and a very low coefficient of friction, important from the application point of view.

Application is simple. The tape is wound directly off its pack on to the thread and in the direction of the thread.

Since the material is applied with the same lay as the thread, when the connection is screwed up, even further tightening takes place and a firmer seal made. In this connection, since the material is soft, it readily distorts, and then the pressure of the screwing action moulds it to the contours of the thread. There is, however, a danger that the electrical continuity of conduit will be interrupted.

The permanent nature of p.t.f.e. gives two important advantages. In the first place the complete reel can be used up without waste. Secondly, no matter how old the joint is, it can readily be unscrewed by finger pressure—as distinct from hardened conventional joints. The economics are also quite impressive in spite of the high initial cost of the materials. One reel (costing about 10s) will make about 200 joints on a ½ in. pipe. It only takes about 30 sec to make such a joint, thus cutting labour costs.

TRANSFORMER FILLING

INSULATION and cooling of a newly designed range of gas-filled steel dry-type transformers marketed by International General Electric is carried out by perfluoropropane (C_3F_8). The gas is non-flammable, non-explosive and non-toxic, and according to IGE, will not decompose even under extreme operating temperatures. Because of C_3F_8's superior insulating properties, impulse levels of the new transformers are higher than those of previous nitrogen-filled units. The perfluoropropane transformers are also smaller and lighter.

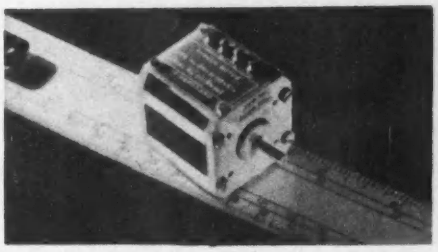
Electronics at Farnborough

CONCENTRATED EFFORT TO LIGHTEN PILOTS' TASKS

WITH only two major British civil aircraft, the VC.10 and de Havilland "Trident," in advanced stages of production and one, the BAC 111, in the design stage, it is, perhaps, natural that this year's exhibition at Farnborough is largely concerned with the various contributions that the many aircraft accessory firms are making to them. Much of the equipment is basically electronic and it is in this field that one notices the greatest advances in technique and design.

With higher operating speeds and greater densities of traffic in the air lanes and around airports, the task of both pilot and ground-control officer is onerous and exacting. When weather shuts down visibility to a few yards, the task of landing an aircraft safely is so hazardous that diversion to less obscured airports or emergency landing grounds is still the preferred operational practice to relying on the talking-down plus integrated landing systems which, linked with ground radio beacons, in theory are adequate for a safe landing, even in zero visibility.

The indefinite factor is, of course, pilot response. Though there are points at which instrumentation, no matter how precise and effective, cannot supersede the decisions of the human mind, these decisions are themselves dependent upon the assessment of a number of factors which have to be assimilated and intercorrelated and the time taken to do so. The factors include height, airspeed, drift, pitch, bearing, yaw, position in relation to the landing runway, rate of drop, position of other aircraft in the vicinity, etc. All of these have to be read from instruments or received from ground control or radio beacon signals via earphones and used as a basis upon which to decide the proper adjustment of engine throttle settings, flap position and flying controls. With good visibility, much of this becomes instinctive as the aircraft nears the landing strip. But the strain of concentrating the eyes on faintly perceptible ground marks and the ears on talk-down information in poor visibility is considerable and must affect the speed of response to mental stimuli.

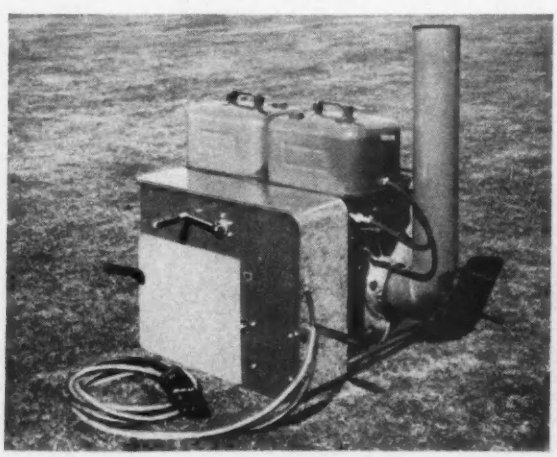


A tiny torque motor used to operate servo-valves

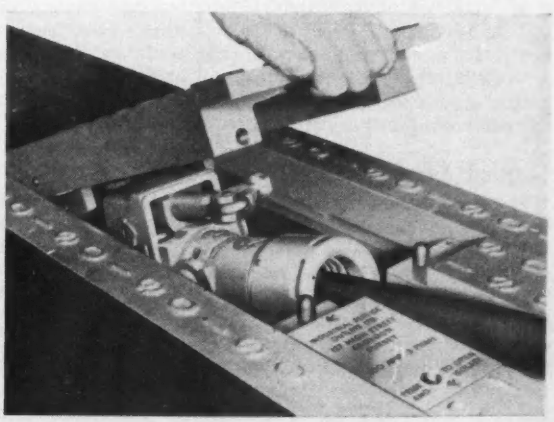
Computers in Aircraft

A great deal of thought and effort has gone into resolving this problem, which affects aircraft safety where it is most vulnerable, in busy airport areas. Though the ground controller's task is less onerous than the pilot's in relation to a single aircraft, this is more than offset by the problem (which the pilot escapes) of organising the stacking, order of descent and landing runway for a number of aircraft circling and approaching the area while, at the same time, arranging for the take-off of other aircraft from the airport. To facilitate the work of both pilot and ground control, the tendency is to devise computers which take in much of the information and resolve it into a single item for presentation to the pilot or ground-control officer. He is then enabled to make his decisions without having to indulge in mathematical calculations or estimates.

Both in airborne and ground-based computers, there must be a degree of intercommunication since neither can fully perform their function without corresponding data from the other. Ultimately, of course, the airborne com-



A hand-started 50 h.p. Perkins Mars gas turbine coupled to a 9 kW d.c. generator makes a compact ground power unit



A new development for airfield apron areas, this service outlet by ISO of Croydon provides a safe connection to main electrical supplies and a flush surface when not in use. Similar outlets supply water, compressed and chilled air for cooling civil aircraft on tropical airports

puter could provide the necessary signals to the automatic pilot to take over the complete control of the aircraft in the approach and landing operation. Similarly, in the control tower, the ground-based unit could provide a complete picture of the position, direction and speed of every aircraft in the vicinity with its identification code marked and with their reaction to ground control's instructions as they are issued.

This stage of development is not so far off as some may imagine. Many British companies are working, both individually and in co-operation, on computers and blind-flying equipment in conjunction with aircraft makers and operators and also with the Blind Landing Equipment Unit of the Air Ministry. It naturally involves a considerable increase in airborne electronic equipment, but the electrical demands and weight of equipment are today minimised by the extensive use of transistors in circuits which have reached a high degree of reliability and service-free life.

On the aircraft, digital computers are preferred to analogue. The latter, though simpler and smaller in many applications, have limited use and so require separate computers for each function. The more flexible application of the digital computer combined with techniques which enable it to perform a series of functions, in sequence so rapid that it appears to be simultaneous, make it the preferred choice, both as regards ultimate weight and bulk.

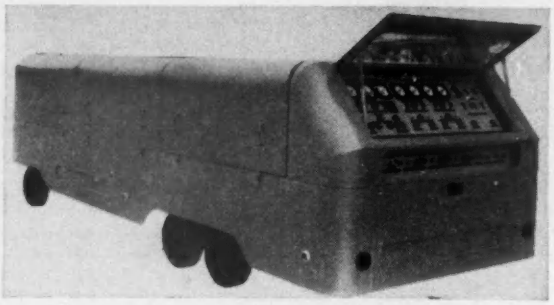
Presentation Methods

Another aspect of the same problem is the method of presentation of information to the pilot. Great advances are being made here. The older warning lights on panels and the reading of meters and instruments situated out of the line-of-sight of the pilot can be replaced by methods in which the warning message is presented in three-colour letters on a small c.r.t., while instrument readings are projected at infinity as a light pattern superimposed on the aircraft windscreen. The latter idea, known as "PEEP"—Pilot's Electronic Eyelevel Presentation—is a product of the Rank Cintel organisation.

Blind-landing equipment, using "leader" cables laid each side of the runway radiating signals which, acting on the auto-pilot and auto-throttle equipment of the aircraft enable it to be brought down to the runway without any intervention by the pilot, has been developed by the industry in co-operation with the BLEU at Farnborough. It has now made over 5,000 successful "hands-off" landings with military and civil aircraft on test flights and is currently being designed for installation on certain types of RAF squadron aircraft and planned for both the VC.10 and de Havilland "Trident," as and when convenient to apply. To meet conditions where the leader cable system is too difficult or expensive to install on airfields, a compatible system using a box pattern of radio signals from ground-located transmitters is also being developed.

Ground Trucks

Though the contribution of the electronics industry to the Farnborough exhibition is a large one, there are many other, less exotic, developments which will play a part in Britain's future civil and military aircraft. One development which involves a change in ground equipment is the introduction of a.c. generation on aircraft. On an airport which caters for a number of different makes and nationalities of airliners, each with its individual electrical system and starting arrangements, ground trucks must be available which will suit every one of them. One composite ground trailer designed by Auto Diesels Ltd. will supply up to 60 kVA of three-phase a.c. at 208/120 V 400 c/s 120 kVA of three-phase a.c. at 105/60 V 185 c/s,



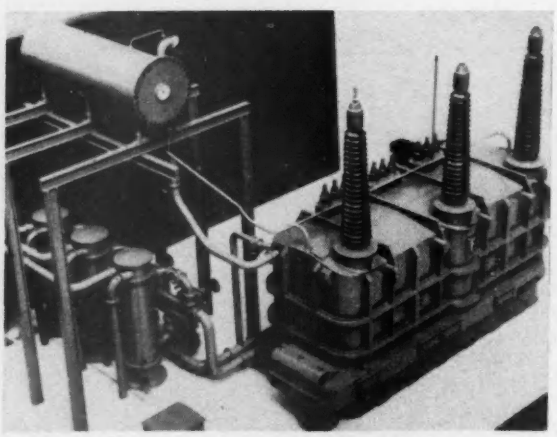
This newly developed trailer ground truck by Auto Diesels Ltd. incorporates a 165 b.h.p. AEC 6-cylinder diesel engine coupled to 65 kVA and 120 kVA alternators with rectifiers to provide a full range of a.c. and d.c. supplies to suit all nationalities of aircraft

21 kW at 28 V d.c. continuous, 70 kW at 28 V d.c. ten-second rating, 44·8 kW at 112 V d.c. continuous and 95·1 kW at 112 V d.c. five-second rating. At the other end of the scale is a compact portable gas-turbine driven 9 kW 28 V d.c. generator unit by Perkins Gas Turbines, of Peterborough.

No Farnborough show would be complete without its display of flying and, despite unfavourable weather on the early days, it was again a brilliant exhibition by members of the services in both helicopters and high-speed aircraft.

570 MVA TRANSFORMERS

FOUR 570 MVA double-wound, generator transformers are to be built by Ferranti for the CEGB generating station at West Burton. These, it is claimed, will be the largest generator transformers in the world and they will operate in conjunction with the station's four 500 MW turbo-alternators. The transformers will be delta-star connected, 22/430 kV, with high-speed resistor transition on-load tap-changers to give ±10% voltage variation in 18 steps. A 5-limb core construction will be used, to comply with height restrictions, with mitred 45° joints to minimise core loss and magnetising current. The core will have the Ferranti backbone construction which utilises fewer corebolts than conventional core constructions. To keep down the unit weight to 215 tons, aluminium tanks and core clamps will be used. The value of the order exceeds £1 million.



A model of one of the 570 MVA generator transformers which Ferranti are to build for the 2,000 MW West Burton station of the CEGB

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to facilitate tasks; all make instructive reading.

Domestic Refinements

YOUR contributor, Mr Lambert (31 Aug.) recommends a separately fused lighting point near domestic fuseboards and also, in the living room, a lighting standard connected to a power point. (Incidentally, in my apprentice days we always referred to 10 A and 15 A switch-sockets as heating points, a term I still prefer to use.)

In the works where I am in charge of electrical installations, we have local lighting points adjacent to most distribution boards. Those who read "Readers Views" may have noticed that, despite my careful approach to the use of m.c.b. types of distribution, I have made use of this form of control and, at my home, I have inserted a separately fused neon indicator in the front of the distribution board, so enabling me to see at a glance if the main fuse is intact.

My living room is illuminated in the main by twin bracket lights, two of which are on a second circuit. I have also taken the precaution of using a separate circuit for the garage lights, together with other outside lights such as the porch and fuel store area.

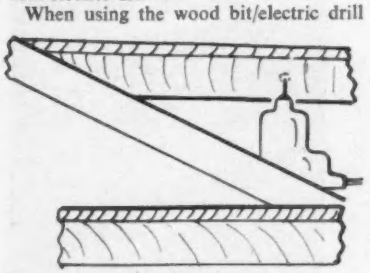
A refinement I have used in the living room is the use of a number of twin 2 A sockets one of each pair being controlled by a switch at the door. This enables handy control of standard or table lamps to be effected which, incidentally makes for greater safety.

A "gimmick" much appreciated by members of my household is a push-button switch inserted in the centre of a 4-gang switch by the door which controls the socket feeding the radio.—*L. Giltrow.*

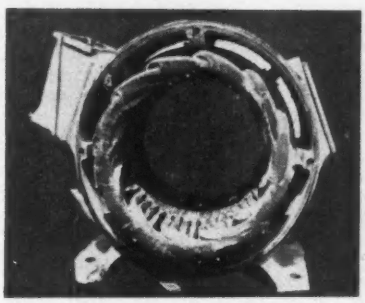
Drilling Joists

REGARDING the contribution by F.S. (10 Aug.), is he not aware that there are many excellent wood bits on the market specially designed for use with electric drills?

When using the wood bit/electric drill combination for drilling joists, though it certainly speeds up production and drills beautifully clean holes, considerable effort may be needed where the timber of the joists is "green," and the work can often become exhausting. The most suitable angle to drill from the point of view of drawing-in the cables is, of course, at right angles to the joist but, unfortunately, this means working in the position least suited to applying the proper load. There are occasions on which it is necessary to apply leverage with a board as shown in the diagram and, though this may need the assistance of a second person, one to guide the drill and the other to apply the leverage, it can still be the means of saving considerable time on a job. For the purists who consider this to be an abuse of the tool, while a drill somewhat heavier than the ordinary handyman's type is preferable, we have found that, with careful handling, there has been no deterioration in our drill after more than two years in use. But would not a purpose-made electric drill attachment for applying the correct leverage in such circumstances be a welcome innovation?—*Nanohm.*



A simple method of applying leverage when drilling joists



A combination of loose bearing end shield and out-of-adjustment ball bearings caused this damage to a motor's insulation

"Dusty" Miller

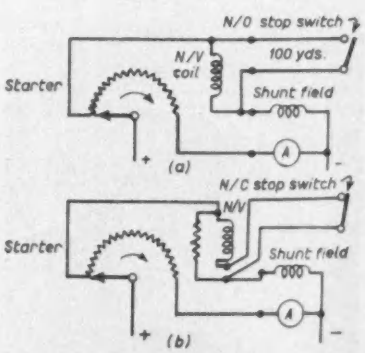
A 35 h.p., three-phase s.c. motor driving a mill had been in service for some years. One morning the operator reported that he could not start the motor and, according to the electrician sent to investigate, the overload tripped at every attempt to start. The motor was therefore taken down and sent to a local rewinder where the cause of the trouble was quickly disclosed.

The motor cooling fan had rubbed the stator winder insulation at one point shorting the turns on one coil. The cause appeared to be some end play as the result of the drive end ball bearing being a sliding fit on the shaft and the non-drive end a sliding fit in the bearing cap. Through fixing screws being loose, mill dust had accumulated between the non-drive end bearing cap and end shield bearing cap face, the displaced end cap permitting longitudinal movement and allowing the fan to rub the stator windings in one position.

There were no burns on the fan which supported the contention that, when running, the pull of the field centred the rotor and the rubbing only took place when running down after the current had been switched off. When the insulation on several turns had been removed by abrasion, as shown in the photograph, the short-circuited turns caused the starter to trip.—*"Trouble-shooter."*

Marine Trip Trouble

IN a marine installation remote trip buttons were called for on an upper deck level and, in one case, this was provided by a 100 ft run of cable which was connected across the no-volt coil which, in turn, was in series with the motor shunt field. Operation of the button was intended to short the no-volt coil and trip the starter but in one instance it failed to do so. The resistance of the cable run was too high. After considering several schemes it was found that the best and simplest was to insert a normally-closed button in series with the trip coil and a resistance across the coil as in the diagram. Using a variable resistance in the first case to determine the correct value for best operation it was found that one about three times the resistance of the coil gave the best results.—*"Indiana."*



To compensate for resistance in long, trip-cable runs, a convenient method is to shunt the trip-coil with a suitable resistor

new products and appliances

Chart-recorder price cuts

SUBSTANTIAL price reductions, as detailed below, are announced for George Kent multi-point chart-recorders.

16-point from £437 to £355.
12-point from £406 to £350.
8-point from £374 10s to £346.
6-point from £343 10s to £342

These are mains operated instruments available for use with various input sources including thermocouples, resistance thermometers and radiation pyrometer elements. *George Kent Ltd., Biscot Rd Wks, Luton, Beds.*

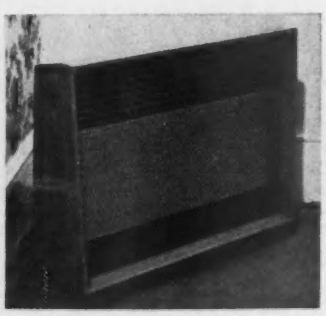
Compact semi-automatic washer

HAVING many attributes of more expensive machines yet remaining in the medium price range at 72 gn, English Electric's semi-automatic washer, "Liberator Tumble-Wash" was shown for the first time on Monday. It is due for national distribution from the beginning of October. A space saver, being only 25 in. wide, it will take a load of between 6 lb and 7 lb of clothes in its 19 in. dia tub. The big advantage of this appliance is that it washes, rinses and spin dries all in the one drum which has a washing speed of 60 r.p.m. and when spin drying revolves at 570 r.p.m. For water heating, a 2·75 kW immersion heater is built in and controlled by a thermostat with four settings between 90°F and 185°F. Washing is carried out by the tumble action and water temperature can be selected by setting the required heat on a control panel. When the water reaches desired temperature, the clockwork timer is set for the appropriate time, and washing action commences. Spinning and pumping sequences are controlled by levers housed behind a drop-down panel on the front of the washer. Manufacturers say that no special plumbing is necessary as the filling hose will fit most sizes of tap. The door, which can be either right- or left-hand opening, has an inset window of heat resistant glass with a central covered aperture to insert soap powder when the tub is filled. As a safety precaution the door handle is removable and the machine will cut out if the door is opened during any sequence. Suitable only for a.c. supplies this washer has a ½ h.p. continuously rated induction motor. Vibration is reduced by interior spring suspension. With a working surface height of 34 in. and an overall depth of 25 in. "Liberator Tumble-Wash" is finished in either white or cream stove enamel with blue control panel. *English Electric Ltd., Strand, W.C.2.*

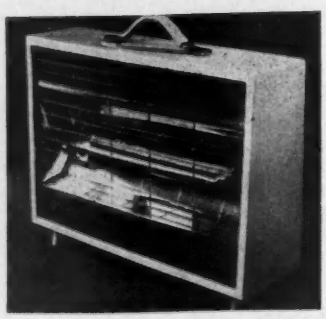
EE's semi-automatic washer. Shown for the first time this week

Heaters have contemporary styling

TWO contemporary styled convector heaters have been announced by Chalex for the winter heating season. The first of these, type BC 111, a conventional convector heater, is available with either 1½ kW or 2 kW ratings. Selling at £9 3s 10d for the smaller model and £10 4s 4d for the larger, it is 20 in. wide by 17 in. high and measures 7 in. deep. The second model, type CF 112, available in a combination of three ratings, incorporates a radiant element which is rated at either 1 kW or 1½ kW, according to individual requirement. This model stands on four short legs and has a wire grille facia with twin switches at the bottom. Slightly larger than the other model, type CF 112 is 22 in. wide and 17½ in. high. Prices range from £12 12s 5d to £14 14s 8d. Both models are available in either silver grey, lilac pink or leek green finish and have chromium plated safety grilles. *C. Hounslow and Co. Ltd., Southwick, Sussex.*



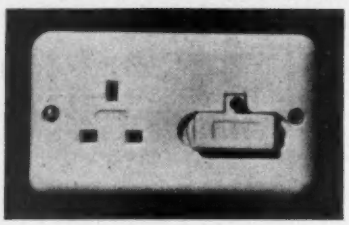
Two new convector-type heaters from "Chalex."



One incorporates an infra-red element

Socket/spur connector

A NEW combined socket and spur connector from Nettle provides a single plate designed to mount on the two gang BS 1363 type box with one BS 1363 socket-outlet and spur connection positioned side by side. The spur connector is provided with BS 1362 removable fuse link mounted to an easily removed fuse carrier. This fuse carrier can be detached from the front of the plate by unscrewing a finger nut.



Intended for the connection of fixed appliances to supply, the spur connector and socket costs £6 4s/doz. in brown, and £6 16s in ivory. *Nettle Accessories Ltd., Harper Rd, Wythenshawe, Manchester 22.*

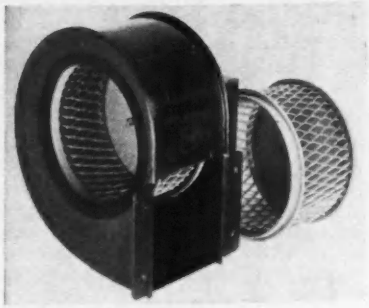
4,200°F thermocouples

THERMOCOUPLES for use at temperatures in the 3,000°F to 4,200°F range are now available for use in both oxidising and reducing environments. The maximum temperature is achieved by a couple comprising tungsten and a 26% rhenium-tungsten alloy, the thermoelectric output being nearly three times as great as that of present-day tungsten-rhenium couples; moreover, the temperature e.m.f. graph is more linear in the 2,000°F to 4,000°F range. Another thermocouple employs 30% rhodium-platinum with 6% rhodium-platinum and this is suitable for continuous use up to 2,732°F or intermittently up to 3,272°F.

These new alloy type thermocouples do not suffer from excessive grain growth, vaporisation, contamination or other disadvantages of the usual platino-rhodium types and the error is said to be less. *Honeywell Controls Ltd., Greenford, Middx.*

Price Increases

British Central Electrical Co. have announced price increases for their "Navy" handlamps. New prices, which are effective from 18 Sept. are 13s 6d for the standard model and 15s for the lamp with E.S. and brass lampholders.



An unusual type of centrifugal impeller which uses mesh instead of blades

Fan uses new concept

A NEW type of fan which is simple yet combines all essential requirements has been developed by Heat Pump and Refrigeration. Called "Mesh Fan," it incorporates an impeller formed in mesh from such material as expanded metal or plastics. The mesh has characteristic diamond shaped pattern of narrow strands which, during the stretching operation in manufacture are given a small inclination. Thus the mesh, when made into a cylinder, provides a rigid but light centrifugal impeller with hundreds of small blades. The cylinder, once formed, is fitted with a diaphragm and connected to the motor shaft before being placed in a scroll shaped housing which collects air and directs flow. Full production of this type of fan with outputs ranging from 25 c.f.m. to 200 c.f.m. is scheduled early next year, but a small 4 in. model with a 70 c.f.m. output is due to be introduced shortly. *Heat Pump and Refrigeration Ltd., Lansdowne La, Charlton Village, S.E.7.*

New colours for fan heater

FOLLOWING a survey on colour preferences conducted at the EDA Sales Conference, Parkinson Cowan have decided on a new range of finishes for their "Elfin" fan heater. Visitors to the PC stand at Harrogate were asked to indicate their preferences both from the personal and selling point of view. The result is that finishes are now available in gold, maroon, blue and red. "Elfin" sells at £7 15s 9d including purchase tax and surcharge. *Parkinson Cowan Appliances Ltd., Stechford, Birmingham 33.*

Embossing tool

A HAND embossing tool in kit form shown this year at the ASEE exhibition by Hellermann under the name of "Dymo-Mite" is now available. It enables labels to be produced both horizontally and vertically on a wide range of p.v.c. and metallic tapes. The tool can be supplied with two separate dies which are easily interchangeable. Tapes can be supplied either with or without adhesive backing. *Hellermann Ltd., Gatwick Rd, Crawley, Surrey.*

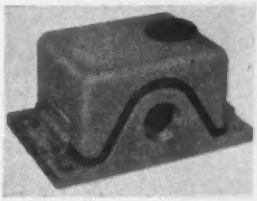
Blankets for winter season

A RANGE of electric blankets, "Thermat," by H. J. Baldwin, are now available for the winter heating season. In this series are the "Regal Medium," single size, selling at £5 0s 9d, including tax, and the "Regal Double," which retails at £7 11s. Both these models are single heat non-thermostatic types, with neon-illuminated double-pole "on/off" switches. Less expensive are the "Lylux" series which cost £3 18s single size and £5 14s double. Both "Thermat" and "Lylux" blankets carry two-year guarantees. *H. J. Baldwin Ltd., Gamble St, Nottingham.*

Frequency multiplier

IN electronics research a frequency multiplier has two main uses. The first is where a test frequency is required which is above the range of existing frequency generators; the second is where it becomes necessary to measure small frequency deviations from a set level. A multiplier of this type which operates as a free-running VHF oscillator over the 30 Mc/s to 300 Mc/s range, and which, therefore, enables frequencies between 3 Mc/s and 30 Mc/s to be multiplied by ten, is the Rohde and Schwarz Type XVD multiplier now available in the UK from Aveley Electric.

The multiplier can also be used for the accurate measurement of frequencies in the UHF and SHF bands. Here, a decade frequency measuring system is used. The output from the multiplier side of the instrument is fed to a harmonic generator and the harmonic output is then fed, with the incoming unknown frequency source, to a mixer. Any difference between the two frequencies appears as a beat note, which is fed back to the frequency multiplier, where it is amplified and measured on a frequency difference indicator. The characteristics of the XVD multiplier are such that it can also be used in numerous other applications, particularly in association with instruments in the Rohde and Schwarz range. *Aveley Electric Ltd., South Ockendon, Essex.*



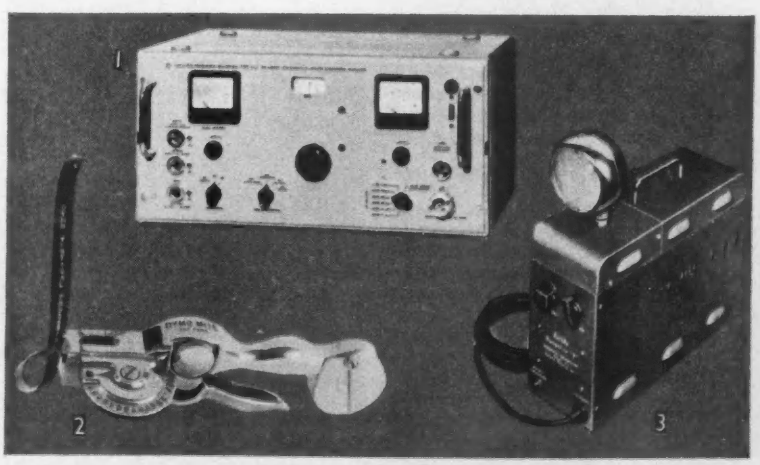
The "Vibraswitch"

Vibration detector

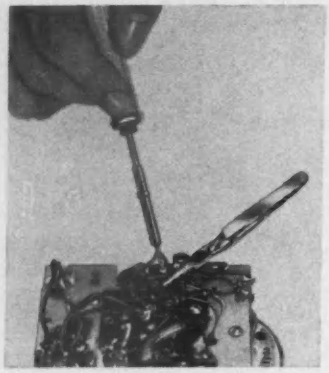
VIBRATION in any rotating or reciprocating machinery, unless intended, is an indication of out-of-balance which can set up cyclic stresses leading to early failure unless rapidly detected. On electrically driven machinery, a device which detects vibration and which trips the control breaker as soon as it exceeds a predetermined value can save its cost on the first operation. Such a device is the "Vibraswitch," marketed by Electro Methods Ltd. Bolted to a suitable point on the machine, it will close an electric circuit as soon as the vibration becomes excessive, the circuit sounding an alarm or even tripping the starter as may be required. The "Vibraswitch" can be supplied with or without electrical reset and hold-on coils. It is also available in watertight or explosion-proof housings. *Electro Methods Ltd., Caxton Way, Stevenage, Herts.*

Portable emergency lighting

A NEAT, self-contained, portable emergency lighting unit weighing only 30 lb yet giving 3½ hours' light with a 36 W bulb and containing its own trickle charger, the Exide "Keepalite P" is designed for locations where a permanent emergency lighting installation is impracticable. The unit is permanently plugged into an a.c. supply point and this keeps the battery charged and the light switch opened so long as the a.c. supply is intact. Failure of the mains immediately switches on the light and keeps it burning from the 12 V internal battery until supply is restored. The light is then extinguished and the battery recharged automatically. *Chloride Batteries Ltd., Exide Wks, Manchester.*



(1) The "Aveley" Type XVD x10 Frequency-multiplier. (2) The Hellermann "Dymo-Mite" embossing tool. (3) The Exide "Keepalite P"



An inexpensive heat sink saves damaging sensitive capacitors, transistors, etc., by conducted heat while soldering

Heat sink

AN ever-present hazard when soldering in the confined spaces of electronic assemblies is that of damaging heat-sensitive components, such as small capacitors, transistors, diodes, etc., by heat conducted from the soldering iron along the connecting wires. The interposition of a cold mass in contact with the wire between the soldered joint and the component serves to absorb any conducted heat and so safeguards the component. Most service engineers are aware of this and fabricate their own devices to act as heat sinks. Now, a simple and effective production heat sink has been marketed at a price which makes the devising of such tools unnecessary and uneconomic. Made by the makers of the Antex precision soldering iron, it is listed at 1s 4d. *Anglo-Netherland Technical Exchange, 7-8 Idol La, London E.C.3.*

New Hellermann sleeves

A NEW range of identification sleeves, "Helagrip," has been released by Hellermanns. Made from high quality p.v.c. and designed for affixing to cables without the aid of tools, "Helagrip" is supplied in sizes covering cable diameters from $\frac{1}{4}$ in. to $\frac{7}{16}$ in. The individual numbers are interlocking and remain in position even when the cables are turned through 90°. "Helagrip" is supplied in a standard colour of white with black printing coded from A to Z and 0 to 9, in strip form partially cut to ensure correct positioning of the marker. *Hellermann Ltd., Crawley, Sussex.*

Flush counter

A FLUSH fitting counter with a range up to 9,999, which counts backwards from a predetermined value set by the adjustment of the toothed drums under a hinged flap is announced by Stonebridge Electrical. The instrument is arranged with an in-built rectifier for use on 230/240 V a.c. supply; the counting rate is up to 25 impulses a second.

A separate relay can be provided for automatic resetting after the zero count has been reached and additional contacts allow the number of resetting cycles to be indicated on another counter. *Stonebridge Electrical Co. Ltd., Queen Anne's Gate, London S.W.1.*

New f.h.p. motors

IN the new range of fractional horse power motors announced by Crompton Parkinson, the mounting dimensions which have been adopted are those of the American standard, NEMA 42, while in other respects they comply with BS 170.

There are four main types: a shaded pole, designed to ensure a low noise level, a capacitor-start induction-run, a capacitor-start-and-run and a split-phase. All are available with drip-proof enclosure and, in addition, the shaded-pole motors can be supplied as totally enclosed, rated either for operation in an airstream or in still air. All have a centre height of $2\frac{1}{8}$ in.

The new range is designated T.30 and they can be mounted either with end-shield or base support. Standard shaft dia is $\frac{3}{8}$ in., but $\frac{1}{2}$ in. shafts can be supplied at slight extra cost. T.30 motors are available from 1/40 h.p. at 1,350 r.p.m. in shaded pole, still air cooled, to $\frac{1}{4}$ h.p. at 1,425 r.p.m. in drip-proof split-phase or capacitor motors. *Crompton Parkinson Ltd., Aldwych, London.*

Twin speed air conditioner

DESIGNED for smaller offices, shops and cafés, is a room air conditioner which has been announced by Carlyle Air Conditioning and Refrigeration. It has twin speeds which enable the conditioner to operate at top capacity when first switched on, and normal capacity to maintain a comfortable temperature. Measuring $26\frac{1}{2}$ in. wide by 18 in. high and 24 in. deep, this unit is compact and has an output capacity of 18,000 B.Th.U./hr. An easily read control dial is used to select desired temperature which is maintained under thermostatic control. Air-flow can be directed through a wide angle by means of a one piece frontal deflector and a centrifugal fan is used to propel the air stream at a maximum output of 500 c.f.m. Air may also be directed from the sides of the unit by means of two sets of louvres. Finished in stove enamel and weighing 210 lb the conditioner sells at £215. *Carlyle Air Conditioning and Refrigeration Ltd., London.*

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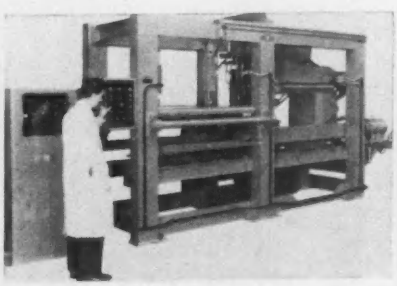

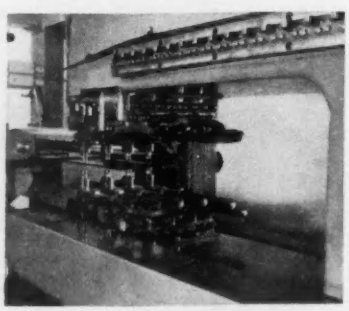

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Heat sink

AN ever-present hazard when soldering in the confined spaces of electronic assemblies is that of damaging heat-sensitive components, such as small capacitors, transistors, diodes, etc., by heat conducted from the soldering iron along the connecting wires. The interposition of a cold mass in contact with the wire between the soldered joint and the component serves to absorb any conducted heat and so safeguards the component. Most service engineers are aware of this and fabricate their own devices to act as heat sinks. Now, a simple and effective production heat sink has been marketed at a price which makes the devising of such tools unnecessary and uneconomic. Made by the makers of the Antex precision soldering iron, it is listed at 1s 4d. *Anglo-Netherland Technical Exchange, 7-8 Idol La, London E.C.3.*

New Hellermann sleeves

A NEW range of identification sleeves, "Helagrip," has been released by Hellermanns. Made from high quality p.v.c. and designed for affixing to cables without the aid of tools, "Helagrip" is supplied in sizes covering cable diameters from $\frac{1}{4}$ in. to $\frac{7}{16}$ in. The individual numbers are interlocking and remain in position even when the cables are turned through 90°. "Helagrip" is supplied in a standard colour of white with black printing coded from A to Z and 0 to 9, in strip form partially cut to ensure correct positioning of the marker. *Hellermann Ltd., Crawley, Sussex.*

Flush counter

A FLUSH fitting counter with a range up to 9,999, which counts backwards from a predetermined value set by the adjustment of the toothed drums under a hinged flap is announced by Stonebridge Electrical. The instrument is arranged with an in-built rectifier for use on 230/240 V a.c. supply; the counting rate is up to 25 impulses a second.

A separate relay can be provided for automatic resetting after the zero count has been reached and additional contacts allow the number of resetting cycles to be indicated on another counter. *Stonebridge Electrical Co. Ltd., Queen Anne's Gate, London S.W.1.*

New f.h.p. motors

IN the new range of fractional horse power motors announced by Crompton Parkinson, the mounting dimensions which have been adopted are those of the American standard, NEMA 42, while in other respects they comply with BS 170.

There are four main types: a shaded pole, designed to ensure a low noise level, a capacitor-start induction-run, a capacitor-start-and-run and a split-phase. All are available with drip-proof enclosure and, in addition, the shaded-pole motors can be supplied as totally enclosed, rated either for operation in an airstream or in still air. All have a centre height of $2\frac{5}{8}$ in.

The new range is designated T.30 and they can be mounted either with end-shield or base support. Standard shaft dia is $\frac{3}{8}$ in., but $\frac{1}{2}$ in. shafts can be supplied at slight extra cost. T.30 motors are available from 1/40 h.p. at 1,350 r.p.m. in shaded pole, still air cooled, to $\frac{1}{4}$ h.p. at 1,425 r.p.m. in drip-proof split-phase or capacitor motors. *Crompton Parkinson Ltd., Aldwych, London.*

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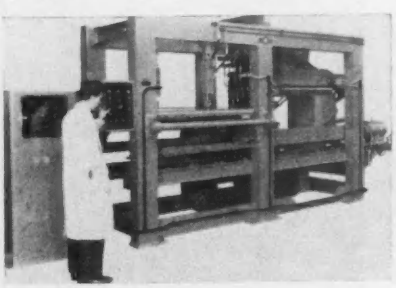

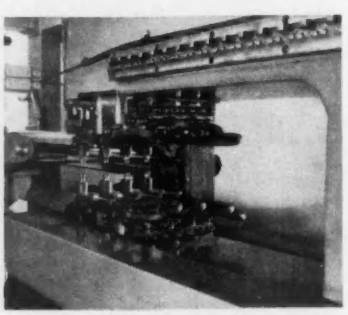

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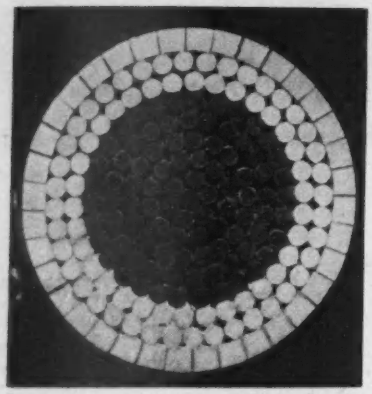


Cross-section of the s.c.a. conductor for the Thames 400 kV crossing described in *Electrical Times* for 7 Sept. Special accessories including armour rods, corona bells and dead end terminations were designed by Alcan Industries. The dead ends, suitable for a loading of 40 tons, withstood 126 tons before failure on test.

U.S. Claims Highest Thermal Efficiency

A YEAR'S operation at a thermal efficiency of 38·1% is claimed for the Clinch River, 450 MW plant of the American Electric Power Co. This is said to be the first time that an efficiency exceeding 38%, corresponding to a heat rate of 9,000 BthU/kWh, has been attained. Throughout the year, the plant operated at 8,975 BthU/kWh, a heat rate corresponding to a conversion efficiency of 38·1%.

An average thermal efficiency of 34·31% was reported for Britain's most efficient station, Blyth A, in the last CEGB report. However, it should be noted that thermal efficiency of British plant is based on units sent out whereas the heat rate is applied to conversion efficiency and therefore also includes units generated for auxiliaries.

NO RASH OF DISCOUNT STORES—YET

SIX months after Grandways took the plunge at Leeds, how are discount stores faring in this country? Perhaps the most significant thing is that there are still few of them, but the two or three now well established seem to be doing well enough. Grandways are said to have reached a turnover around the £1 million a year mark, even though they are no longer handling several makes of appliances since Prestige and Frigidaire obtained price-cutting injunctions against them. They are still able to offer such cuts as £7 1s on a Hotpoint "Iced Diamond" refrigerator and £6 18s 6d on a Hoover Mk II washing machine, say *Which?* in a survey of the movement. Running the gauntlet of these manufacturers' adamant support of resale price maintenance, the store collects goods from wholesalers in unmarked vans. So long as they can get away with it, these discounts mean sales.

Supa-Save at Southend are not quite the same kettle of fish in as much as they do not, for the most part, handle the larger appliances, they are located near a main shopping centre and are attached to a department store. They are content with trimming shillings off the price of toasters, irons, mixers and so forth. No clues have been given as to their turnover, but their pattern of trading has some of the best of both worlds.

Which? in their September issue predict that discount stores will increase in number, but not as rapidly as in the US because of resale price maintenance and British shopping habits. Confirmation of this seems to be forthcoming already. The r.p.m. injunctions have dissuaded some from following in Grandways' footsteps, but not all. Clyde Discount Centre have just started trading in Glasgow and London Grocers plan to open at Romford soon.

Also in their September issue, *Which?* report on tests of small hair dryers. They tested two samples of each of the 20 models on the market early this year and awarded their main recommendation to the Morphy-Richards HDA2, though there was little to choose between most makes. In the slower air speed category, they gave first preference to the Pifco Princess and Bridges Luxury Life. The Moulinex is considered to have serious faults from the safety aspect.

OFFICIAL PUBLICATIONS

National Engineering Laboratory. Annual report, 1960. HMSO, 5s (see page 377).

BS 158. Marking and Arrangement of Switchgear Busbars, Main Connections and Small Wiring. 5s.

BS 634. Air-drying Insulating Finishing Varnish for Electrical Purposes. 4s.

BS 1647. Specification for pH Scale. 4s 6d.

BS 216. Vulcanised Fibre Sheet for Electrical Purposes. 6s.

BS 903. Methods of Testing Vulcanised Rubber. Part A21, Determination of Rubber-to-Metal Bond Strength. 3s.

BS 156. Enamelled Copper Conductors (Oleo-resinous Enamel). Part 1. Round Wire. 7s 6d.

BS 1844. Enamelled Copper Conductors (Enamel with Vinyl Acetal Base). Part 1. Round Wire. 8s 6d.

Defence Guide. DG-5120. Resistors, Variable, Wire-wound and Composition. HMSO, 2s 6d.

EASTERN E.B. PRESS ON WITH RURAL ELECTRIFICATION

NOT before time according to local farmers, rural electrification is forging ahead in Suffolk and Norfolk. Eastern Electricity Consultative Council was told on Friday that a further 1,030 rural premises were being connected in Suffolk as a result of mains development during the six months to 31 March, and 825 in Norfolk.

The meeting also discussed after-hours service by the Board. A case had occurred in Suffolk where the occupant of a cottage had objected to being charged £2 6s for the repair of a fuse at night, on the basis of a minimum charge of three hours' labour costs. As the occupant had been advised on the telephone that the cost would be at least £2, the consultative council supported the Board's charge, mainly on the grounds that consumers in general should not be required to subsidise service to the individual.

Another question of service had been raised by Colchester and District Trades Council, who had written to Eastern EB urging them to seek power for the compulsory periodical inspection of all electrical apparatus and powers to inspect all wiring installations before they were covered up. The Board replied that it seemed unlikely that legislation to approve compulsory inspection would be forthcoming, since this would require powers of entry on consumer's premises, and that inspection would be of little value unless there were further power to compel repair. Instead, they recommended using a contractor on the NIC roll for all installations.

B.E.A.M.A. PUBLICITY CONFERENCE

BEAMA's publicity conference will this year be held on 7 Nov. and 8 Nov. The venue is once again the Connaught Rooms and the chairman will be Mr G. M. C. Peacock, chairman of the BEAMA publicity and exhibitions committee. The conference will occupy the whole of the first day, with delegates being invited to ATV studios in the evening, and will terminate on the second day with a formal luncheon at which the guest speaker will be the Hon H. G. Nelson, managing director of English Electric.

The programme is being arranged along the lines requested by the majority of delegates at last year's conference, and the subjects of the six sessions are expected to be: The Company Image: Its Creation and Value; Letterpress or Litho for Trade and Technical Literature; Publicity Overseas; A discussion session entitled "What Would You Do?"; the Law in Relation to Advertising; and Publicity: Vital Ingredient of Marketing.

IRISH ELECTRICIANS GO BACK

THE 18-day strike of 2,600 electricians in Eire is over—in a ballot they accepted a new pay offer of 10d an hour extra, plus a reduction in the working week, and returned to work on Friday last. The new pay rates are 5s 9d an hour for a 42½-hour week in Dublin, 5s 9d an hour for a 45-hour week in Cork, Limerick and Waterford, and 5s 8d an hour for a 45-hour week elsewhere. The new offer was made at a conference of representatives of the employers — electrical contractors and traders and the Electricity Supply Board—and of the two unions (the ETU (Ireland) and the Irish Engineering, Industrial and Electrical Trade Union), presided over by the industrial secretary of the Irish Congress of Trade Unions.

It was not necessary, therefore, for the Government of Eire to invoke its powers under the new Bill, to which we referred last week.

Initially, the dispute only concerned electricians in the contracting industry, in addition to about 800 with the Electricity Supply Board, of whom some 450 were engaged on operation and maintenance work at various power stations. During the strike the power supply position in Eire became acute at times, but the Board was able to maintain supplies, thanks to the untiring efforts of administrative and technical staff. But the strike has brought into the open the industrial discontent of the Board's manual workers, who refused to pass the electricians' pickets at the power stations, even when directions and appeals were made to them by their own trade unions. They made it clear that this refusal was prompted as much by indignation at the treatment of their own claims as by sympathy and support for the electricians. These manual workers also returned to work with the withdrawal of the pickets and on an assurance by the Board that all their outstanding claims would be dealt with expeditiously.

Equipment for Dungeness

SIX 2,000 h.p. and six 1,625 h.p., 2,960 r.p.m. squirrel-cage motors have been ordered from AEI by Harland Engineering Co. for the h.p. and l.p. boiler feed pumps for Dungeness nuclear power station. AEI are also to supply four 1,625 h.p. 965 r.p.m. squirrel-cage induction motors and gearboxes for the Drysdale circulating water pumps for the station. Motors previously used for this class of duty at other nuclear stations have been 250 r.p.m. direct coupled machines, and this is the first order for 965 r.p.m. geared motors, which are smaller and less costly than 250 r.p.m. machines of the same rating. In addition, AEI Motor and Control Division will supply 35 new type multimotor control centres for the control of pumps, fans and valve motors for the reactor auxiliary equipment, reactor gas turbines, boilers, steam turbines and water treatment and decontamination plant. Total value of the orders for motors and control gear is £271,000.

Burco Dean buy Garage

BURCO Dean have acquired a car service station at Enfield, Middlesex, suitable for accommodating a fleet of their vehicles. To effect the purchase, they have acquired the whole of the issued capital of two private companies, Bullsmoor Garages and Bullsmore Investments. Price is undisclosed.

Clean Air Conference Next Month

NEARLY 1,000 delegates will attend the twenty-eighth conference of the National Society for Clean Air, to be held at Brighton from 4 Oct. to 6 Oct. A large part of the conference will be devoted to studying the working of the Clean Air Act, and there will also be papers on whole house-warming systems and the problems of smoke control. A special feature this year will be a transatlantic telephone discussion between a panel of experts on the platform at Brighton and a panel in New York.

RETAIL SALES HIGH

SALES of durable goods seem bound to have eased in August as an aftermath of the "little Budget," but preliminary estimates of the BoT indicate that retail trading as a whole continued at the record level of the previous month. The provisional index for August is 117, 6% higher than a year earlier.

SOUTH AFRICAN TARIFF CHANGES

SEVERAL changes in the South African Customs' tariff are announced. Among these, plastics insulated flexible cord from the UK now incurs a minimum duty of 7½%, while the intermediate duty is raised to 12½%. For three-phase motors (excluding a.c. commutator and synchronous types) the UK rate for between 1 h.p. and 75 h.p. is 25%, with an intermediate rate of 30%, and for those of between 75 h.p. and 350 h.p. the UK rate is 15%, and the intermediate rate 20%.

L.P.S. Electrical Closing Down

ONE of the casualties of the price war which developed in cables after the RTP Court outlawed the manufacturers' agreement, LPS Electrical will close down this month. Attempts over the past 15 months to sell the business as a going concern have failed, and now the plant and stocks from the firm's works at St. Leonards-on-Sea will be auctioned at the Queen's Hotel, Hastings, on 11 Oct. and 12 Oct. Until the assets have been sold, the receiver, Mr E. C. Baillie of Messrs Layton-Bennett, Billingham and Co., is unable to say whether creditors will be fully covered.

Asked by the ELECTRICAL TIMES, a spokesman confirmed that LPS is not the firm which advertised in the *Financial Times* in July as being a manufacturer of thermo-plastics cables in the London area interested in a merger or sale. An old-established firm numbering the UK and overseas governments, GPO, railways and electricity authorities among their customers, LPS moved from London to St. Leonards in 1956, but retained an office in Drury La.

Right, the four 6 in. diameter steel pipes being lashed to oil drum floats prior to being floated into position and laid on the river bed. Above, manoeuvring the pipes into position

33 kV Cable Under the Thames

33 kV oil-filled power cable and associated pilot cables, laid in steel pipes, have been laid across the River Thames, between West Weybridge and Laleham, by the AEI Construction (Cables and Lines) Division

New Electric Resistance Tube Mill

DEMAND for electric resistance welded steel tubing is growing, so Tube Investments will give first priority to the erection of a factory for this type of tube on the 280-acre site which they have just purchased at Washington, Co. Durham. Preliminary work will start early next year and by 1965 the mill is expected to have 750 employees. The plant will be highly mechanised and incorporate many advanced engineering features. Subsequent factories will be erected in accordance with a development programme for the production of various types of steel tubes and other TI products. Eventually, the labour force will be over 3,000.

BULPITTS ACQUIRE BIRMINGHAM FIRM

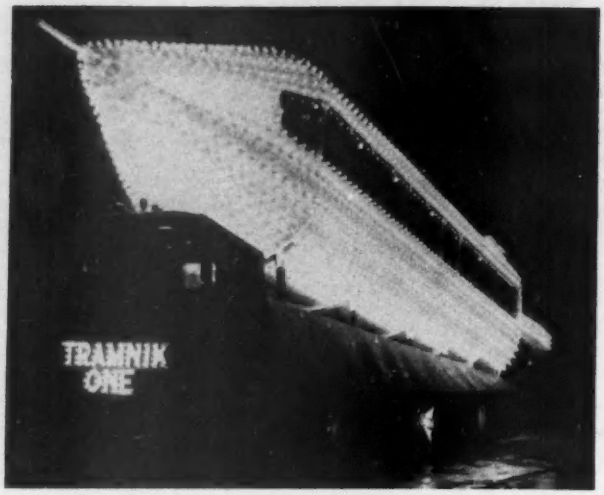
BULPITTS (Swan Brand) have expanded their capacity for producing electric kettles and aluminium holloware at Birmingham by acquiring the whole of the issued capital of Webshaw Manufacturing Co., metal press workers and spinners, for £103,500 cash. The former owners of the new subsidiary have agreed to continue as full-time directors. Profits of Webshaw in the current year to 30 Sept. are expected to be not less than the £24,000 earned last year.

Coal by Wire

THE strong link between the coal mining and electricity supply industries is being publicised by South of Scotland EB in a series of press advertisements under the general heading of "Electricity is Coal by Wire." Aimed mainly at dispelling miners' fears of redundancy, the advertisements have been appearing in daily and weekly newspapers in S. Scottish mining and industrial areas during the last few months. The Board estimates that its use of coal will double by 1970 to 6 million tons.

Tramnik launched

Coining a new word, Blackpool's illuminations, inaugurated last Friday, included this "Tramnik One," a former tram which has been transformed into a rocket ship with hundreds of lamps. The illuminations, along six miles of promenade, continue until 29 October



G.E.C. TACKLE PROBLEMS OF LOW PROFIT AND HIGH OVERDRAFT

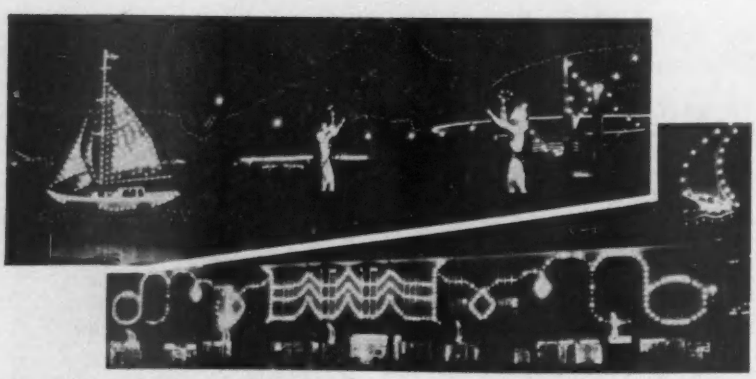
A DIFFICULT situation was outlined frankly by Mr A. L. G. Lindley when he delivered the chairman's address at the annual meeting of GEC last week. Two serious problems, he said, were engaging the board at the present time; first, the unsatisfactory level of profit and second, finance. An audience of over 100 shareholders sat quietly while Mr Lindley told them that overdraft had increased further from £11¼ million at the end of March to £13 million, and other borrowings had risen from £2 million to £3½ million. Of this total of £16¼ million, which the balance sheet suggests still leaves net current assets at around the £50 million mark, £8½ million was accounted for by Hunterston nuclear station, and the volume of other large engineering and telecommunications projects under way was also much higher than five years ago with a consequent increase in work-in-progress. The chairman predicted that the overdraft would remain at its present level for a short period, then reduce as contracts were fulfilled and seasonal factors took their effect. He quashed any ideas that the board propose to make a rights issue, even though the 7% Bank rate is a serious burden. In answer to a question, he said that financial outlay on Hunterston was unlikely to go higher than at present and no further provisions for loss were expected to be necessary, though the final outcome would not be known for a couple of years.

Shareholders already knew from their balance sheets that profit on trading was a meagre £2·9 million on turnover of £118·6 million, or 7% of capital, plus reserves. Mr Lindley said there was no sign yet of any improvement in heavy engineering price levels, and that it was unfortunate that at a time when profits were low the industry was beset by problems of rapid change in design.

Despite all this and the burden of the major reorganisation now under way, trading results for the first four months of the current year indicate a recovery in profits for the full year as compared with last year's exceptionally low level. Prices apart, there are signs of improved trading and "the overall position shows an upward trend."

Another point which Mr Lindley touched on was the Common Market. In the event of the UK becoming a member, it was likely that GEC would manufacture some goods on the Continent and establish a system of licensing and cross-licensing. Already a financial interest had been taken in a small firm manufacturing lamps in France and agencies arranged for the sale of a number of products in Europe. He also disclosed that the Magnet Hse premises, eventually to be sold, are largely leasehold.

All recently appointed and retiring directors were returned to office and at the conclusion of the meeting, a shareholder's expression of complete confidence in Mr Lindley was applauded by the meeting.



Aiming ultimately to be the "Blackpool of Wales," the seaside resort of Barry Island has introduced decorative illuminations there for the first time. South Wales EB, in co-operation with the borough engineer and the local traders' association, were responsible for their design and erection

Retailers Want Better Warranties

THE question of manufacturers' warranty terms is not being allowed to die. At the National Chamber of Trade autumn conference in London, on 10 Oct. to 11 Oct., Barrow-in-Furness delegates will urge that pressure be brought to bear on manufacturers to provide for the immediate repair or replacement of faulty goods under warranty. They will also move that manufacturers should refund expenses incurred by the customer in returning goods. These conditions are necessary to protect the retailer's goodwill, they say.

Listeners Answered Back

UNEXPECTEDLY, there was little criticism of overhead power transmission lines during the BBC's Light Programme relay from Crawley New Town last Thursday, when Sir Christopher Hinton and Mr Norman Elliott answered listeners' questions. But the discussion did show that the Supply Industry was fully alive to all the points raised, and prepared to examine new views and ideas.

After dealing with a question on the likelihood of a repetition of the power failure which occurred in South-East England a few months ago, it was emphasised that excessive delay in granting wayleaves for power lines could prove costly to the industry. Sir Christopher also gave comparative costs of overhead and underground high voltage lines of equivalent capacity as £47,000 per mile overhead and £1,200,000 underground for 400 kV lines.

Mr. Norman Elliott also revealed that the CEGB's bulk supply tariff to operate from next April would probably include reduction in the night time price which the boards could pass on to consumers.

The camouflaging of substation sites, and future power sources were among other subjects raised and adequately answered.

Sayings OF THE WEEK

"Gross negligence is what we are never guilty of." . . . SIR CHRISTOPHER HINTON, in a BBC broadcast.

"Like most of my colleagues, I shall leave others to secure their 'bargains' in the Edgware Road, and hope that 1962 will see the refrigerator for which I have been looking." . . . J. BLAYDON, writing to the *Financial Times*.

"Things which go up and down cannot be scaled up as easily or as elegantly as things which go round and round." . . . MR F. H. S. BROWN, at the British Association meeting.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, September 12

	£ per ton	Weekly change £		£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	231½	−4	ZINC, virgin, min. 98% purity (cash)	72½	−3½
,, (3 months)	234½	−3½	,, (3 months)	73	−3½
LEAD, refined pig, 99·97% purity (cash)	64½	−⅛	RUBBER, per lb No. 1, RSS, spot	25⅞d	+1/16d
,, (3 months)	65⅛	—	c.i.f. basis, ports, Nov. ...	25⅛d	−1/16d
TIN, refined, min. 99·75% purity (settlement)	944	−38	ARMOURING: Galv. Steel Wire (0·104 in.) ...	68½	—
(3 months)	951	−37	Mild Steel Tape (0·04 in.) ...	53½*	—
ALUMINIUM, ingots 99·99·5% wire bars (4×4×54")	193½	—	NICKEL (home)	660	—
BRASS Strip 63/37	198⅜	—	MERCURY (76 lb flask)	63	—
SILVER (Troy oz)	79⅛d	—	AMERICAN PRICES: Copper, electrolytic (per lb) ...	31c	—
			Lead (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

NEW 6s OFFER FOR CLYDESDALE

A CONSORTIUM of eight finance houses, all themselves creditors of Clydesdale Supply Co., have provided a way out for the unsecured creditors of the company with an offer of full repayment to those with claims of £25 or less, and 6s in the £ plus a possible share allotment for larger creditors. Following the withdrawal from the scene of an unnamed London group and Craibstone Investments, with potential offers of 7s 6d and 6s, respectively, creditors unanimously indicated acceptance of the new offer at a crowded meeting in Glasgow on Friday.

Members of the consortium are Bowmaker, Forward Trust, Lomond Trust, Mercantile Credit, Olds Discount, Scottish Discount, Scottish Midland Guarantee Trust and Yeoman Credit. The offer is conditional upon acceptance before 20 Sept., and it was stated that the Commercial Bank of Scotland had made £700,000 available to meet the relative payments. A share allotment to creditors would depend upon finding the reorganisation of the company warranted, in which case the intention would be to offer non-voting shares to the nominal value of 10% of admitted claims. At 1 July last, Clydesdale had a deficiency of £2·14 million, and since then the chain of household goods stores in Scotland has been losing several thousand pounds a week. Mr Edward Levine has already handed over 1·8 million shares to the consortium for a nominal sum of £1, contingent upon their offer being accepted by creditors.

Advances in Packaging

PACKAGING manufacturers seem to have excelled themselves in producing new methods and materials for packing but the electrical trade, especially in the consumer market has been left sadly behind. This was obvious at the International Packaging Exhibition currently at Olympia where the accent on eye appeal in salesmanship has made its mark. There are bubble packs for screws, drills and ball bearings and even brightly coloured egg containers but, the lamp must appear in its corrugated carton with pastel colours. Electric blankets and hair dryers still are sold in their cardboard cartons which, although they have brightly coloured motifs do not seem to have as much attention paid them as products in other fields. Last year some £600 million were spent on packaging but manufacturers seem to have forgotten that attractive packing for electrical goods will have the same eye-appeal as for other products.

News in Brief

Next year's annual conference of the Electrical Contractors' Association will be held at Eastbourne commencing on Thursday, 17 May. The annual dinner will be at Grosvenor Hse, Park La, on 13 Feb.

The Bradford Institute of Technology have just issued a prospectus of courses available in the Department of Electrical Engineering for the 1961-62 session.

EDA is to have a stand at the exhibition arranged in conjunction with the annual conference of the Association of Teachers of Domestic Subjects at Victoria Halls, Bloomsbury Sq, W.C.1, on 23 Sept.

The South Western Electricity Board have acquired premises in Duke St, Tavistock, to where their showrooms will be transferred.

Annual dinner of the Birmingham Electric Club is to be held at Grand Hotel on 20 Oct.

Final of the Electrical Industries' National Golf Championship will be held on the Southport and Ainsdale golf course on 2 Oct.

The Dimplex advertising campaign for the coming heating season, 50% up on the previous year's programme, begins next month.

Perth District won the large showroom section of North of Scotland HEB's recent showroom display competition, and Stonehaven District the small showroom section.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Twin Falls Scheme

Planned for commissioning next June, the 120,000 h.p. Twin Falls hydro-electric project of the British Newfoundland Corporation Ltd., is well up to schedule. Hamilton Falls Power Corporation Ltd., a Brinco subsidiary, has taken an option for a 99-year lease on the waters of the upper Hamilton River from the government of Newfoundland. The lease is considered to be of material assistance to the company in continuous discussions with consumers, and prospective consumers, of electricity who might be interested in the 4 million h.p. potential at Hamilton Falls. The parent company has under consideration additional financing which will be required to maintain the programme of development and survey work.

Shawinigan Interconnections

The Shawinigan Water and Power Co. has reached agreement in principle with the Quebec Hydro-Electric Commission covering a long-term bulk purchase of power commencing in 1966. This is to take care of anticipated load growth beyond that date when the two new power projects, at Tracy and at Rapide des Coeurs (to which we have already referred) are fully utilised. The company is also building a 345 kV line from Isle Malique to Quebec City to permit the interchange of additional power between the Shawinigan system and that of the Aluminium Co. of Canada as from November, 1962.

St. John Scheme

Construction of the St. John River multi-purpose project with a strong interconnecting grid system between New Brunswick and Maine, is recommended by the New Brunswick Electric Power Commission in its annual report for the year ended 31 March last. A survey has already revealed that a total potential of some 900 MW of hydro power exists in the Canadian section of the river, plus about 460 MW which could be developed in the US reach of the river. The Commission's own staff have undertaken studies of a site at Mackaquai, about 15 miles above Fredericton, considered suitable for a 415 MW plant, and from load growth estimates it is judged that further thermal generation will have to be added to the system within the next three years. Work is already well advanced on construction of the new Courtenay Bay power station where the first of six 50 MW turbo-generators is due for operation this month. Gross peak on the Commission's system in the year to 31 March last rose 7·8% to 237,500 kW, and a total of 1,128 million units were sold. Average domestic consumption increased to 2,176 units. Possible system interconnections with other utilities, similar to that recently inaugurated with Nova Scotia, have been under preliminary discussion. In particular, a link with the Quebec Hydro Electric Commission is being proposed. Meantime, nuclear power developments are being studied, although it seems that the use of such stations would not be justified in Nova Scotia within the next decade.

PARAGUAY

HE Loan

The head of the Administración Nacional de Electricidad, Paraguay, recently visited Washington to negotiate a loan of US $22 million from the Inter-American Development Bank, to be used to supplement the technical and economic assistance received from Brazil for the construction of the hydro-electric plant on the Rivers Monday and Acaray.

SWEDEN

Nuclear or No ?

How soon should Sweden go ahead with a nuclear power project? To that question different answers have been given by the State Power Board and the AB Atomenergi. The latter concern, a company largely financed by the State but including some private interests, is of the opinion that the projected power plant, at Marviken, near Norrköping, should be built as soon as possible, with the aim of having it in operation by 1967 at the latest. But the State Power Board are not convinced that the economic case for the project is strong enough at the present time, although it is prepared to go ahead with the plan if there are other adequate reasons. So the decision has been left with the Swedish Parliament. The Power Board has estimated the cost of the Marviken nuclear plant at about Kr400 million, and this higher cost would involve the raising of electricity tariffs by at least 6%, they maintain. On the other hand, Atomenergi argues that although other fuel has become cheaper recently the lower prices now ruling for uranium would make nuclear power more competitive.

U.S.S.R.

Stalingrad Completed

Stalingrad hydro-electric station, on the Volga River, claimed to be the largest in the world, was officially opened by Mr Khrushchev last Saturday. With 22 turbo-alternators, each of 115 MW capacity, the station is the seventh to be completed on the Volga-Kama network. Construction of a further two stations totalling 3,600 MW, is well advanced, and plans are being prepared for two more. Associated with the latest Stalingrad station is a 500 kV transmission line to the Moscow area, but another line, possibly 800 kV, is to run to the heavy industrial centre in the Urals.

RHODESIA

Locomotive Orders

Rhodesian Railways have just placed two orders for locomotives to a value of over £2½ million. One order, worth some £1,300,000, awarded to English Electric Co. Ltd. is for 16 1,875 h.p. diesel-electric locos similar to 35 already supplied by the company, one of which recently established a record of 14,062 miles in a month. They have a 1—Co—Co—1 wheel arrangement, and are designed for 3½ ft track gauge. The other contract, worth about £1¼ million, has been placed with Brush Electrical Engineering Co. Ltd. and is for 14 main line diesel locomotives each with diesel engines developing 1,730 h.p. These are for operation on the 3½ ft gauge track between Bulawayao and Malvernia.

GHANA

Volta Loan

A loan of about £35 million promised by the World Bank, the US Government and the British Government for the Volta River project has finally been agreed upon, according to Mr K. A. Gbedemah, Ghanaian Minister of Health and member of the Presidential Commission. The loan will be payable between the next 20 years and 25 years and, under the agreement, the World Bank will lend $47 million, the US Government $37 million, and the British Government $14 million. The total loan will be disbursed by various agencies of the World Bank to cover purchases abroad in connection with the Volta River project. The Minister said that work on the first stages of the scheme was expected to start about October.

INDIA

Nuclear Tenders

A total of seven tenders from the UK, Canada, France, and the USA have been received by India in response to the global inquiry for the construction of a 300 MW nuclear power station near Tarapore in Maharashta State. It is anticipated that assessment of the tenders will be completed within five months, after which any recommendation will go

to the Government of India and the Atomic Energy Commission for consideration. Present plans aim for initial site work on the station to be started by next March. Evaluation of the technical details of the tenders is the responsibility of the Department of Atomic Energy and the Central Water and Power Commission, but financial and other matters will be referred to the Union Ministries concerned, with the State Electricity Boards of Maharashta and Gujarat being consulted on certain points. India is already thinking of a second nuclear power station, and has arranged for Canadian experts to undertake a survey for a suitable site, as we earlier reported.

US Order

The $23 million contract for a central power station in Gujarat obtained by the General Electric Co. of America, to which we briefly referred last week, provides for the installation of four 63,500 kW turbo-generators in a thermal station to be established at Dhuvaran, we now learn. That company is also to supply mechanical and electrical equipment and provide the necessary engineering services. Although the plant is intended to be coal-fired there is to be provision for future conversion to oil.

Supply Improvement

The Ahmedabad Electricity Co. Ltd., in Gujarat State, is anticipating a considerable easement of the power supply situation with the commissioning of a new 30 MW generating set next March and a further machine of similar capacity a year later. Installed capacity of the company's Sabarmate power station is now 157,500 kW, and a peak load of 149,200 kW was carried during the year ended 31 March last. Certain controls have had to be introduced to confine the demand within the limits of the plant capacity.

Kanpur's Problem

Like many other electricity supply undertakings in India, the Kanpur Electricity Supply Administration has suffered from the troubles which usually follow delay in replacing obsolescent generating plant. Such delays are usually caused by difficulties in obtaining finance and foreign exchange for the import of the necessary equipment. That situation has applied in Kanpur for several years. but at last there are indications of an improvement, and as the first step in alleviating some of the Administration's troubles a new 15 MW turbo-alternator together with two 150 klb/hr boilers are expected to be commissioned next year. Urgent measures are also planned, to meet industrial expansion, for the establishment of a new power station with three 60 MW sets. In the year ended 31 March last, the Kanpur undertaking sold over 300 million units, compared with 277¼ million in the previous year, and although only 2,050 kW additional load was connected, maximum demand rose by 3,545 kW to 57,760 kW.

PAKISTAN

Lamp Protection

The Government of Pakistan have now decided to continue protection to the indigenous incandescent electric lamp industry for a further period ending December, 1962. This follows the recommendation of the Tariff Commission who had considered representations by the local manufacturers.

Ninefold Power Rise

Since independence, power production in Pakistan has increased nine times and has now reached the level of nine lakh kW. Projects are under development by WAPDA and by the Karachi Electric Supply Corporation to increase generating capacity. Recent additions to generating capacity have included the 13·5 MW Shadiwal hydro station, the 20 MW Hyderabad station, the 16·4 MW Goalpara steam station and the 160 MW Warsak hydro station.

Village Electrification

The Government of West Pakistan has decided to electrify every village in the province and all such villages which have a population of 1,000 or have at least 250 pukka houses. The aim is to complete the task within the next ten years. The Provincial Government has entrusted the work of assessing the requirements of power in the province to the West Pakistan WAPDA, which have appointed an American firm as general consultants to carry out a survey during the next six months.

AUSTRALIA

NSW Increase

An 8·6% increase in sales of electricity during the 12 months ended 30 June last is reported by the Electricity Commission of New South Wales. Total sales amounted to 7,498 million units, compared with 6,904 million in the previous year. Average bulk selling price during 1960-61 was 1·59d, slightly less than in the preceding year. It was the Commission's lowest average bulk selling price for any year since its uniform tariff was applied in 1952-53—the Commission supplies in bulk to various Councils. The percentage increase in units sold was approximately the same as the Commission expected even though sales of electrical appliances declined in recent months.

Queensland's Outlook

A major power station at Callide to serve Central and Southern Queensland would have cost £13¼ million more to build, and £1,860,000 extra in annual cost than a station at West Moreton. This is revealed by Mr N. Smith, State Electricity Commissioner, in a report submitted to Parliament along with a three-volume report by Merz and McLellan, consulting engineers, on the State's future electrical development. The report said the comparison favoured a West Moreton station for Southern Queensland and a separate Callide station for Central Queensland, recommendations which the State Government have already adopted in principle, as we have reported. The projects would also involve the construction of interconnecting transmission lines between the Southern Electric Authority and the Wide Bay-Burnett Regional Electricity Board, and between the Cairns-Townsville system and the Mackay region, estimated to cost £1,830,000 and £460,000, respectively. Final commitment on the Callide plan depends on whether construction of a Kiaga-Gladstone railway line would make the alternative site at Gladstone economically attractive. The consultants' report also said the first stage of a new major power installation in North Queensland would be required for service in 1969. But they were unable to determine whether this should be a thermal or a hydro plant until more information about the cost and a firm energy output of future hydro schemes was available. Should a new thermal power station be the ultimate choice, the best site would be at the Collinsville coalfield.

NEW ZEALAND

Russian Motors

Russian-built induction motors, said to be most competitively priced, are now being offered to industrialists in New Zealand. At the moment the USSR Export Department, Machinoexport, are concentrating on a single-series ranging from 0·6 kW to 100 kW in seven ratings, in addition to two squirrel-cage types. Models of identical output are available for operation with a choice of four speeds—3,000, 1,500, 1,000 or 750 r.p.m. —for motors of rating of 10, 14 or 20 kW. It is also stated that "the terminal box, which is often a great source of trouble, has been replaced by free cable ends. protected by a cover." The protected motors too have no fan "to reduce their service reliability." Standardisation of the assemblies and windings of the protected and totally enclosed air blast surface-cooled motors has also reduced the wire sizes, enabling easy repair, it is further claimed.

PHILIPPINES

Nuclear Plant ?

A 150 MW to 200 MW nuclear plant installed in the late 1960s on the island of Luzon in the Philippines might be competitive over its lifetime with a conventional power plant of the same size. This conclusion has been reached by the International Atomic Energy Agency, based on a report of a three-man mission which visited the Philippines last October to study future nuclear power prospects there. They conclude that such a plant would be competitive with oil-fired plants having an average lifetime fuel cost of 40 cents/million B.Th.U., or $2.40/barrel. The present price of fuel oil is approximately 38 cents/million B.Th.U., and it is assumed that the figure will gradually increase.

Company Activities

BUT for the peak-pipping performance last week of Wall Street the stock market tone in Throgmorton St could easily have been a lot less steady than it was. Aid to sentiment was also offered by the effective £46 million rise in the UK's gold and currency reserves last month and sterling in the foreign exchange market has been at its highest since late-November last year. But overall there still looms the shadow of the Chancellor's recent restrictions on the Economy, the threat of industrial strike action over the Chancellor's policy of "pause" on wages and salaries and, then, to a lesser extent, there is the Berlin political upset to act as a damper on any investment enthusiasms.

Against this background the electrical share market did well to edge generally higher and after starting out the week AEI climbed from 37s 6d to 38s 9d before closing at 38s 3d. Birmingham Sound Reproducers did well with a short spurt from 37s 9d to 40s 3d, while British Electronic Industries (Pye and E. K. Cole) climbed further from 11s to 11s 6d in front of the results and on investment comment in connection with this year's highly successful Radio Show. English Electric sparked up from 30s 9d to 31s 3d before drifting back to close the week at 30s 3d. EMI always a sure responder to Wall St, where a substantial amount of the company's equity is dealt in, lifted from 36s 6d to 38s and Dimplex, the heater firm, jumped a sturdy 3s 6d to 79s 9d, ahead of this week's results.

North Acton's Telegraph Condenser Co.—now a subsidiary of BICC—was one of the few electrical companies to report in last week. Makers of all types of condensers, the company is to pay a same again interim dividend of 5% from half-year profits to 30 June, 1961, amounting to £246,000 before tax. This is substantially below the £346,000 for the first half of 1960 but at the same time it is a 20% improvement over the £205,000 earned in the second half of 1960. Given no more than a repetition of the £246,000 for the second half of this year, earnings on the equity will still amount to around 40% so that, in that case, chairman Mr W. C. Handley should have little difficulty in maintaining last year's dividend and bonus total of 22½% on the Ordinary shares. Although controlled by BICC, a number of the 10s Ordinaries are still in the hands of the investing public and upon publication of these latest half-time figures holders saw their shares drop back from 42s to 41s 3d at which level they now yield 5·45%.

But the biggest item of company news last week, of course, was the annual statement from Mr Arnold Lindley, chairman of the £88 million General Electric Company. He confirmed that the two serious problems which engage the company at the moment are the unsatisfactory level of profit and, second, finance, but results for the four months from 1 April indicate some recovery this year. The shares after opening the week at around 30s 9d quickly climbed as high as 31s 7⅛d following Mr Lindley's remarks, but by the close had dimmed again to 30s 9d.—*From our City Correspondent.*

British Electronic Industries

Dividend is 15% as forecast when this group was formed last November to effect the merger of Pye and E. K. Cole, but is by no means covered. Pye suffered a severe setback in earnings and Ekco incurred a substantial loss. Taken separately, Pye's profit slipped from £2,423,884 to £1,473,902 for the year to March, even though the latest period's earnings include a full year's contribution from Pye (Australia) and six months from Telephone Rentals. Tax commitment is £½ million lower, so net profit shows a smaller decline from £1,386,940 to £1,010,944, from which Pye pay a £665,000 dividend to BEI, whereas BEI's total distribution to shareholders is £757,178. E. K. Cole contributed nothing to BEI, having incurred a loss of £665,429 against a profit of £675,031 last time.

Christy Bros.

Order books remain at a high level, although there may be signs not yet really significant of falling demand in some sections, says the chairman in his annual review.

Eveready South Africa

The rapid growth in earnings over the past few years continued in the 12 months to 30 June, with net profit rising from R439,873 to R517,789 after high depreciation and taxation. Dividend is again increased, a final recommendation of 13% making a total of 19% on capital increased by a one-for-two scrip issue, against an equivalent of 15·56% previously.

Flexible Drives (Gilmans)

After writing off the cost of removing the business from Smethwick to Warwick, trading profit comes out at £28,708, against £29,753 in 1959-60. In addition to a 15% dividend there is a 4d/share distribution from the sale of land at Warstock. The Smethwick property is now available for development or disposal.

Hackbridge Holdings

Uncertainties concerning the Common Market, lower profit margins, and "serious difficulties" in obtaining suitable labour have not diverted the directors from their expansionist outlook. Chairman, Mr A. L. Foulger, says in his annual review that they consider there are great possibilities for expansion within the present group, and that this view will not preclude any sound acquisition. Capital expenditure last year amounted to £72,287 on modernising and expanding capacity and introducing new products, and at the year's end there were commitments for a further £47,750. Starting with a high level of orders, demand in the current year has been encouraging, and judging by experience so far, the directors expect quite satisfactory results.

Year to 31 Mar.	£ Trading Profit	£ Net Profit	% on Ord.		Ord. Price*	
			Earned	Paid	High	Low
1957	418,083	122,168	42·2	20	22/-	11/3
1958	414,607	134,748	47·1	20	15/6	7/6
1959	337,467	137,496	45·6	20	19/9	14/1
1960	296,594	82,376	24·9	20	8/9	5/-
1961	310,997	60,850	8·5	10†	7/-	4/9

* Calendar year, except 1961 which is up to 3 Aug.
† On capital doubled by a scrip issue.

Israel Electric Corp.

After allowing for sizeable differences with regard to depreciation and tax, due to adjustments on previous years, earnings are slightly higher than last year at £6,828,327. Dividend is 7½% on Ordinary and "A" Ordinary shares.

W. H. Sanders (Electronics)

A newcomer to the share lists, this Stevenage, Herts, firm has declared a dividend of 17½% against a forecast 15%, though trading profit is slightly lower at £93,536 for the year to 30 June against £107,168 previously. After £44,834 tax, net profit comes out at £48,702 of which the dividends absorb £15,313. Making a wide range of microwave and industrial electronics equipment, the company has proved popular with investors, the shares placed at 4s 4½d in March, 1960, having touched 28s 3d early this year and now standing at around 18s 6d.

Telegraph Condenser

Trading improved in the first half of this year compared with the second half of last, but was still well below the level of January, 1960, to June, 1960. Directors now report a profit of £246,000, subject to tax, for the six months to June, against £346,000 in the corresponding period last year. Even if demand for condensers did not rise in the second half of this year, and profits matched the first half, earnings rate would be around 39%. Interim dividend stays at 5%, which was followed last year by a final 17½%.

Telephone Manufacturing

Following the sharp recovery in the 15 months to March, this Pye subsidiary expects a further improvement in profits in the current year. The order book is full, says the chairman in his annual report.

Dividend Announced

Allied Insulators. Interim 5% (*same*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

15 Sept.—Belfast. Provision of lighting services in Arlington Hse, Windsor Ave, for Ashleigh Hse School.—See 31 Aug. issue.

15 Sept.—Carrick-on-Shannon. Lighting, electrical heating, etc., installations in new post office.—See 31 Aug. issue.

15 Sept.—Co. Armagh. Electrical installations in Crossnaglen Voluntary Intermediate School and school meals accommodation.—See 24 Aug. issue.

15 Sept.—Malvern U.D.C. Erection of 298 Group "B" columns/lanterns.—See 31 Aug. issue.

15 Sept.—Rhayader P.C. 900 yd Group "A" 140 W sodium lighting.—See 31 Aug. issue.

16 Sept.—Alnwick R.D.C. Contract 19/1961. Provision of additional lighting and power points, etc. at 12 Shepherds Hill. Engineer and Surveyor, O. M. Farrell, 34 Green Batt.

16 Sept.—Cheshire C.C. Applications invited for select list.—See 24 Aug. issue.

16 Sept.—East Barnet U.D.C. Contract 953. (a)(i) Supply and erection of 60 30 ft steel columns/brackets; (a)(ii) removal of 55 existing mercury lanterns and uprooting of 62 steel trolley poles; (b) supply and fitting of 60 200 W linear sodium lamps/lanterns/gear; (c) wiring for A1000 Gt. North Rd lighting.—See 24 Aug. issue.

16 Sept.—Morley B.C. 52 140 W sodium street lighting units on 25 ft concrete columns (22 columns to support o.h. wiring) along A62.—Advertised 17 Aug. issue.

18 Sept.—Maidstone B.C. Floodlighting of The Old Palace.—See 7 Sept. issue.

18 Sept.—Manchester C.C. Electrical installation in combined clinic, Withington.—See 7 Sept. issue.

18 Sept.—Normanton U.D.C. Partial rewiring of public baths, High St.—See 7 Sept. issue.

18 Sept.—Poyton-with-Worth P.C. 55 concrete columns and sodium lanterns for Class "A" street lighting—Advertised 17 Aug. issue.

18 Sept.—Sleaford U.D.C. 17 Class "A" columns/equipment.—See 7 Sept. issue.

18 Sept.—Stirling B.C. Electrical work in 25 houses. New house redevelopment.—See 7 Sept. issue.

18 Sept.—Willenhall U.D.C. Erection of 35 "Stanton" 10F and 86 8F columns and the provision of lanterns/wiring.—See 7 Sept. issue.

19 Sept.—Musselburgh B.C. 13 15 ft and 15 25 ft concrete columns/mercury/sodium lighting.—See 24 Aug. issue.

19 Sept.—Peterborough C.C. 600 mercury and sodium units on steel and concrete columns together with the removal of existing units.—See 31 Aug. issue.

19 Sept.—Slough B.C. Electrical installation, including underfloor heating, in proposed crematorium, Stoke Pl. Applications to Borough Engineer, Town Hall, by 12 noon, on above date.

20 Sept.—Nantwich R.D.C. Electrical installations in 22 pre-war houses at Dodcott-cum-Wilkesley, Newhall, Broomhall and Sound. Engineer and Surveyor, Stapeley Hse. Fee £1 1s.

20 Sept.—Rayleigh U.D.C. 45 Group "B" concrete columns with tungsten lighting and 23 with sodium lighting along various roads.—See 7 Sept. issue.

20 Sept.—Tyrone C.C. Electrical installation in new primary school, Dromore.—See 7 Sept. issue.

21 Sept.—Dungannon R.D.C. Two pumps/ancillary equipment for Bawn-Carnteel water scheme.—See 7 Sept. issue.

22 Sept.—Doncaster R.D.C. Supply and installation on fixed-price basis of 64 140 W sodium lamps on 25 ft steel columns along A614, Thorne Rd, Austerfield.—See 7 Sept. issue.

23 Sept.—Belper U.D.C. 30 140 W sodium lighting units on pre-stressed concrete columns along A6, Derby Rd, Milford.—See 7 Sept. issue.

25 Sept.—Belfast. Electrical installation in new residential Club for Seamen, Garmoyle St.—See 7 Sept. issue.

25 Sept.—East Devon Water Board. Contract S.2. Duplicate pumps/equipment for Holyford Wks.—See 7 Sept. issue.

25 Sept.—Esher U.D.C. 27 25 ft steel columns/brackets/sodium lamps/gear, etc., along A3.—See 7 Sept. issue.

25 Sept.—Flintshire C.C. (a) Supply and laying of cable and (b) advanced direction signs, etc., for Queensferry By-pass lighting scheme.—See 7 Sept. issue.

25 Sept.—Gravesend B.C. Electrical improvements in 955 houses on Westcourt, Northcourt and King's Farm estates.—See 7 Sept. issue.

25 Sept.—Lytham St. Annes B.C. Nine new concrete columns, 85 c.i. columns, repositioning of 25 c.i. columns and renewal of 42 c.i. brackets on existing columns.—See 31 Aug. issue.

25 Sept.—Urmston U.D.C. Supply and erection of 31 Class "A" lighting units in Trafford Pk. Engineer and Surveyor, Council Offices.

26 Sept.—Birmingham C.C. Replacement of lift, on fixed-price basis, in aged persons' home, Highbury Hall. Details from City Engineer and Surveyor, Sir Herbert J. Manzoni, Civic Centre, to whom the £2 2s deposit should be made payable.

29 Sept.—Cheshire C.C. Applications invited for inclusion in select list for: (f) electrical installations.—See 7 Sept. issue.

2 Oct.—Inverurie B.C. Supply and erection of lighting columns, resiting work and conversion to sodium lighting along A.96.—See 7 Sept. issue.

2 Oct.—Manchester C.C. Renewal and reinforcement of electrical installation in Police H.Q. City Architect, P.O. Box 488, Town Hall.—Advertised in this issue.

2 Oct.—Neath R.D.C. 37 15 ft concrete columns/60 W sodium lamps/lanterns/gear/wiring along B4434, Tonna.—See 7 Sept. issue.

4 Oct.—Stockport B.C. (1) Rewiring of Weights and Measures Office and associated buildings, Castle Yd.—See 7 Sept. issue.

12 Oct.—Northwich R.D.C. Supply and installation of 38 30 ft concrete columns/200 W sodium lamps/lanterns/gear along A49 at Cuddington.—See 7 Sept. issue.

No date stated—Betwys-y-Coed U.D.C. Supply and erection of 63 trunk road lighting columns with sodium lighting. Surveyor and Public Health Inspector: C. A. Kortegas, Council Offices.

No date stated—N. of Scotland H.E. Board. Three mile 132 kV single-circuit steel tower line in Argyll.—Advertised 31 Aug. issue.

No date stated—S. Manchester Hospitals. Applications invited for inclusion in select list for electrical work and for the supply of cables, fittings, lamps and tubes.—See 31 Aug. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

23 Sept.—Jordan. Eleven 15 to 100 kVA 33/·4 kV 3-ph. distribution transformers; 33 kV o/h line steel supports; 3/·147 and 7/·136 copper conductor; insulators and fittings; steel ware; and as a D.L.F. financed contract, switchgear up to 6·6 kV. Kennedy and Donkin, 12 Caxton St, S.W.1. B.o.T. (ESB/28233 to 38/61).*

25 Sept.—Brazil. 130 trolley buses. Companhia de Transportes Urbanos, Rua Bemfica 881, Recife, Pernambuco. B.o.T. (ESB/28258/61).*

25 Sept.—Pakistan. Lighting fittings (44 items). Director of Supply, P.I.D.C. Hse, Motijheel, Dacca. B.o.T. (ESB/28576/61).*

25 Sept.—Pakistan. 10,800 lamps. Chief Engineer, Electricity, W.A.P.D.A., Lahore. B.o.T. (ESB/28508/61).*

26 Sept.—S. Africa. 80,000 telephone insulators, insulator spindles and 500,000 lb cadmium copper wire. Secretary, Tender Board, S.W. Africa Admin., P.O. Box 27, Windhoek. B.o.T. (ESB/28206, 7 and 9/61).*

28 Sept.—America. Three s.-ph. 39/52/65 MVA transformers. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/28210/61).*

30 Sept.—Iraq. Lattice type transmission poles and brackets. Secretary, Purchases and Tenders Committee, Ministry of Municipalities. B.o.T. (ESB/27929/61).*

1 Oct.—Kuwait. Cartridge fuse links (three items). President, Dept. of Electricity, Water and Gas. B.o.T. (ESB/28254/61).*

2 Oct.—Pakistan. 24 V Nife batteries and trickle chargers. Executive Engineer, Stores

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

"Donvin" wattmeter—makers of? O.L.—Donvin Instruments Ltd., 73 Avenue Rd, W.3.

"Beurer" electric blankets—makers of? W.H.P.—E. F. Allchin and Co. Ltd., 253 Bordesley Green, Birmingham 9.

Machines for washing wine and beer glasses—makers of? T.B.—Dawson Bros. Ltd., Gomersal, near Leeds; Hobart Manufacturing Co., Hobart Corner, New Southgate, N.11; Gaskell and Chambers Ltd., Dalex Wks, Coleshill St, Birmingham 4; Kitchen Machines Ltd., St. Andrew's Hse, 32-34 Holborn Viaduct, E.C.1; Moreton Engineering Co. Ltd., Moreton-in-Wirral; Staines Kitchen Eqpt. Co., 131 Victoria St, S.W.1.

"A.E.M." motor starters—makers of? E.E.B.—Airedale Electrical and Manufacturing Co. Ltd., Harrogate Rd, Apperley Bridge, Bradford.

"Nevelin" rectifiers—makers of? T.E.—Lancashire Dynamo Nevelin Ltd., Hurst Green, Oxted, Surrey.

"Titan" stapling device for cables—makers of? R.—Industrial Staplers Ltd., 7-9 Rathbone Pl, W.1.

"Mainstay" cable trunking—makers of? P.R.—W. G. Walker and Co. (Engineers) Ltd., 2 Emery Hill St, Westminster, S.W.1.

"Seagull" oil regenerator—makers of? G.E.—H. A. Harben and Co. Ltd., Rowlands Wks, Kelvin Rd, Wallasey.

Division, Electricity, W.A.P.D.A., Bharat Bldg, Lahore. B.o.T. (ESB/27971/61).*

3 Oct.—America. Two 230 kV c-b's. Dept. of the Interior, Bureau of Reclamation, Bldg 53, Denver Federal Center. B.o.T. (ESB/28849/61).*

3 Oct.—India. One 11 kV o.c.b. for Kargali Colliery. Group Engineer (P), National Coal Development Corpn Ltd., 9 Syed Amir Ali Ave, Calcutta 17. Cash receipt of Rs. 5.

3 Oct.—Iraq. 6,000 lb solder wire with flux ⅛ in. diameter. Iraqi Embassy, 22 Queen's Gate, S.W.7. B.o.T. (ESB/27930/61).*

3 Oct.—Pakistan. Switch fuses, distribution boards, lampholders, c.b's, socket-outlets, plugs, bells, distribution feeders and busbars (41 items). Director of Supply, P.I.D.C. Hse, Motijheel, Dacca. B.o.T. (ESB/28573/61).*

3 Oct.—Pakistan. 11 kV disc insulators. Executive Engineer, Stores Division, Electricity, W.A.P.D.A., Bharat Bldg, Lahore. B.o.T. (ESB/27371/61).*

3 Oct.—Thailand. One 175/200 kW diesel-generator and one 270-300 c.f.m. at 100 p.s.i. compressor. State Railways of Thailand, Yod Se, Bangkok. B.o.T. (ESB/27994/61).*

4 Oct.—Pakistan. Twin p.v.c. insulated service cables. Executive Engineer, Stores Division, Electricity, W.A.P.D.A., Bharat Bldg, Lahore. B.o.T. (ESB/27972/61).*

5 Oct.—Egypt. 63 kV o/h transmission lines for connection of Shoubra and Shouhada switching stations. U.A.R. Embassy, 24 South St, W.1. B.o.T. (ESB/29117/61).*

5 Oct.—India. Two five-ton, one ten-ton and one 15-ton o/h travelling cranes. Details from Co-ordinating Section, India Store Dept., Government Bldg, Bromyard Ave, W.3. Fee 10s. Ref. 2014/61/1 Eng. 3.

5, 9 and 10 Oct.—Pakistan. 3-ph. kWh meters. Executive Engineer, Stores Division, Electricity, W.A.P.D.A., Bharat Bldg, Lahore. B.o.T. (ESB/28504, 27973 and 28505/61).*

7 Oct.—India. Lightning arrestors, gang operated air-break switches, a.c.s.r. conductors, armour tape, sleeves, clamps and twisting wrenches (11 items). Chief Electrical Engineer, Assam State E.B., Shillong. B.o.T. (ESB/28246/61).*

9 Oct.—Pakistan. 400/440 V 3-ph. voltmeters. Executive Engineer, Stores Division, Electricity, W.A.P.D.A., Bharat Bldg, Lahore. B.o.T. (ESB/27974/61).*

10 Oct.—America. One 825 h.p. hydraulic turbine for Beaver Powerhouse, White River. U.S. Corps of Engineers, Little Rock District. B.o.T. (ESB/28554/61).*

10 Oct.—Greece. Reinforced concrete poles (57 items). Public Power Corpn (Purchasing Division), 30 Chalkokondyli St, Athens. B.o.T. (ESB/28844/61).*

16 Oct.—Bolivia. Four 500 kW diesel generators. Corporacion Boliviana de Fomento, La Paz. B.o.T. (ESB/29110/61).*

16 Oct.—Trinidad. Insulators, insulator pins, stay wire, cross-arm tension straps, insulator "D" irons and cross-arms (12 items o/h line equipment). Purchasing Officer, Electricity Commission, G.P.O. Box 121, Port of Spain. B.o.T. (ESB/27902 to 13/61).*

18 Oct.—Kuwait. Twin 7/-029 catenary cable and accessories, plus earthing clamps (six items). President, Dept. of Electricity, Water and Gas. B.o.T. (ESB/28255/61).*

23 Oct.—Australia. Equipment for 66 kV underground connection between o/h terminations and switchyard at Carlingford substation. Electricity Commission of N.S.W., Kelvin Hse, 15 Castlereagh St, Sydney. B.o.T. (ESB/28204/61).*

23 Oct.—India. One 150/30 ton indoor o/h travelling crane for Sharavathi Receiving Station, Bangalore. Chief Engineer, H.-E. Construction Projects, Race Course Rd, Post Bag 60, Bangalore 1. B.o.T. (ESB/27964/61).*

23 Oct.—India. Transmission line equipment: insulators, conductors, ground wire, etc. Chief Engineer (Construction), Punjab State Electricity Board, 9 Ram Bagh Bldg, Patiala. B.o.T. (ESB/28562/61).*

30 Oct.—Nigeria. 90-mile single circuit 132 kV transmission line between Aba/Oji River Power Station. Resident Engineer, E.C. of Nigeria, Adelphi, John Adam St, W.C.2. B.o.T. (ESB/29143/61).*

CONTRACTS PLACED

Bristol T.C. Renewal of lighting installation in main Cash Hall at Council Hse, General Electric Co. Ltd., £875. Recommended.

British Railways (N.E. Region). Signalling equipment, etc., Westinghouse Brake and Signal Co. Ltd. and Enfield-Standard Power Cables Ltd.; medium voltage control tower switchgear for Lamesley marshalling yard, South Wales Switchgear Ltd.

C.E.G.B. (S.E. Region). Contracts placed during August amounting to £562,927 include: Deptford, dust collector units, E. Green and Sons; Brighton "A," cabling works, Johnson and Phillips; Cliff Quay, dust collectors, Babcock and Wilcox; East Ham, 66 kV switchgear, A. Reyrolle and Co.; Stepney, 30 MVA 66/6·6 kV transformers, Fuller Electric; Wandsworth, two 30 MVA, 132/11 kV transformers, Ferranti Ltd.; Wandsworth, two 90 MVA, 132/66 kV transformers, Ferranti Ltd.; Wimbledon, 132 kV switchgear, A.E.I. Ltd.; Medway-Maidstone, overhead line works, Clough, Smith and Co.; Pembury-Marden, overhead line works, Pirelli-General Ltd.; Bury St. Edmunds, 132 kV switchgear modifications, A. Reyrolle and Co.; King's Lynn, civil works, R. G. Carter Ltd.; King's Lynn, 132 kV cabling, W. T. Glover; Hemel Hempstead, civil works, Cawood Wharton and Co.; Peterborough, 132 kV switchgear modifications, A. Reyrolle and Co.

Chilton P.C. Supply and erection of 12 Class "B" street lighting units, General Electric Co.

Dorchester B.C. Erection and painting of steel lighting columns at The Grove, Abacus Municipal Ltd.

Durham C.C. Electric work in: Ryton Modern School additions, Devereux Moodie and Co. Ltd., £10,452; Leasingthorne County Junior and Infant School, Tregonning Ltd., £931 10s.

Southport T.C. Overhaul and extensions to electrical installations in Holy Trinity C.E. (Aided) Primary School, S. Barrett and Co., £2,760. Recommended.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

A-B in design. B813,001. Class 9. Battery chargers, control apparatus, etc. Allen-Bradley Co., 136 West Greenfield Ave, Milwaukee 4, U.S.A.

A-MP in design. 815,988. Class 9. Capacitors, etc. Amp Inc., Eisenhower Boulevard, Harrisburg, Pennsylvania, U.S.A.

Antiference "Vantenna." 808,164. Class 9. Plugs, sockets, etc. Antiference Ltd., 19 Dunraven St, Park La, W.1.

Carbox. 795,457. Class 9. Cells, batteries, etc. National Research Development Corpn., 1 Tilney St, W.1.

Daystrom-Weston. 813,011. Class 9. Apparatus, etc. Daystrom Ltd., Bristol Rd, Gloucester.

Duofric. 819,318. Class 11. Refrigerators, etc. Siemens-Electrogerate Aktiengesellschaft, Oskar-von-Miller-Ring 18, Munich, Germany.

Epeo. B807,274. Class 9. Radio, floor polishing and scrubbing apparatus, vacuum cleaners, irons, etc. B807,275. Class 7. Washing, food-mixing machines, etc. B807,276. Class 11. Refrigerators, toasters, cookers, etc. N. V. Philips' Gloeilampenfabrieken, Emmasingel 29, Eindhoven, Holland.

Flomax and **Flomite.** 808,892 and 3. Class 9. Solenoid operated valves, etc. Laycock Eng. Ltd., Victoria Wks, Millhouses, Sheffield 8.

Frigeco. 819,229. Class 7. Washing and ironing machines. Frigeco S.A., 67-75 Quai President Paul Doumer, Courbevoie (Seine), France.

Multifix. B808,576. Class 7. Cutting, drilling, grinding machines, etc. Loughborough Glass Co. Ltd., 12 Derby Rd, Loughborough.

Pac-sol and **Licon.** 806,134 and 5. Class 9. Electro-magnetic apparatus and current interrupter, solenoids, etc., respectively. Illinois Tool Wks, 7501 North Keeler Ave, Chicago 39, U.S.A.

"Parmar." 814,510. Class 11. Lighting installations, etc. W. J. Parry and Co. (Nottingham) Ltd., Victoria Mills, Draycott, Derbys.

Seemark. 815,797. Class 9. Switches. Seawork Ltd., Burness Hse, 41 St. Mary Axe, E.C.3.

Selmar. 814,138. Class 9. Alarms, anti-theft devices, etc. Stellar Components Ltd., 23-30 Bedford Row, W.C.1.

Singer. 788,470. Class 9. Terminal plugs, capacitors, connectors, etc. Singer Mnfg. Co., 107 Trumbull St, Elizabeth, New Jersey, U.S.A.

Sunbeam. 805,765. Class 9. Apparatus, etc. Sunbeam Corpn., 5600 Roosevelt Rd, Chicago, U.S.A.

Wee Cons. 819,861. Class 9. Condensers. Erie Resistor Ltd., Millora Wks, Beevor Rd, South Denes, Gt. Yarmouth.

TRADE NOTES

Changes of Address. The London sales office of Rowlands Electrical Accessories Ltd. has this week moved to Regent Hse, 89 Kingsway, W.C.2. Tel.: Holborn 3361.

Phoenix Internal Telephones Ltd. and Private Telephones and Electric Co. Ltd. have moved to Hide Pl Wks, Esterbrooke St, S.W.1. Tel.: Victoria 7741.

As from 30 Sept., the Hepworth Iron Co. Ltd. and Hepworth Electrical Developments Ltd. will be at Stafford Hse, 145 London Rd, Kingston upon Thames.

George Pearson (Engineers) Ltd. are moving to 34 College Rd, E.4. The telephone number remains Silverthorn 4476.

The office of A.E.I. Lamp and Lighting Co. Ltd. at 17 Grosvenor St, Cheltenham, has moved to Merchants Rd, Gloucester. Tel.: Gloucester 27663.

Dishwashers in Canada. Electrically operated domestic dishwashers have now been designated of "a class or kind made in Canada," under a new ruling to operate from 15 Sept., announced by the Canadian Department of National Revenue.

Sheffield Office. George Kent Ltd. have opened an office at Lloyds Bank Chmbrs, Earl St, Sheffield 1.

Manchester Depot. British Ermeto Corpn. Ltd. and their associate company, Simplifix Couplings Ltd., are to open a depot on 2 Oct. at Blackett St, off Fairfield St, Manchester.

Distributors. Aero Electronics Ltd., Gatwick Hse, Horley, Surrey, have been appointed sole U.K. distributors for the United Transformer Corpn., of New York.

Agents. Castelco (Gt. Britain) Ltd. have appointed Somelec Sales Ltd., 47 St. Paul's St, Leeds 1, as their stock-holding agents for North East England.

BUSINESS PROSPECTS

Barnstaple. 12 shops, offices, etc., to cost £100,000 planned for Covenant Securities Ltd.; architect: H. Gallannaugh, 54 Queen Anne St, W.1.

Basildon. Extensions planned for Carson Bros. (Productions) Ltd., Honeywood Rd; architects: E. R. Collister and Ptnrs., 41 Buckingham Palace Gate, W.1.

Basingstoke. Wessex Regional Hospital Board, Winchester, propose new district general hospital on 30-acre site in Basingstoke/Newbury and Basingstoke/Tadley Rds. Hampshire C.C., Winchester, propose two primary schools for 840 pupils, Winklebury.

Bentley. U.D.C. propose 37 bungalows, Pipering La, costing £49,000; Surveyor.

Bishop Auckland. G. McCall Ltd., builders, New Herrington, propose 24 houses, Church St, Coundon.

Blackpool. £500,000 development to provide a multi-storey car park with ground floor restaurants, etc., in Princess St, proposed for B.C.

Bolton. Manchester Regional Hospital Board, Cheetwood Rd, Manchester 8, plan occupational unit, Bolton District General Hospital.

Boston. Meldrum and Smith, 22 High St, architects for proposed conversion in three stages of Dominican Friary, Spain La, to theatre for Blackfriars Trust.

Bournemouth. A. F. French and Ptnrs., Pearl Assurance Bldgs, Queen Sq, Bristol, architects for shops and offices proposed, Old Christchurch Rd, for Leek and Moorlands Building Soc., Leek.

Brentwood. Ten-storey office block planned, Warley Barracks site, for Ford Motor Co. Ltd., Dagenham; architects: T. P. Bennett and Son, 34 Bloomsbury Sq, W.C.1.

Cambridge. Extensions to cost £300,000 planned at biochemistry department for University; architects: Hammett and Norton, 29 Sackville St, W.1.

Cardiff. Cambrian Airways Ltd., Rhoose Airport, have placed contract for headquarters to cost £50,000 at airport; contractors: John Morgan (Builders) Ltd., 14 Cathedral Rd. Proposed: major extension to cost £100,000 for Avana Assoc. Bakeries Ltd., Pendyris St.

Chatham. Theobald and Overton Ltd. propose new factory; plans by W. E. R. Randall and Sons, 23 Railway St.

Coalville. Proposed: £100,000 sports and welfare centre, Snibston and Whitwick Collieries; architect: G. L. Grieves, Coalville, Leics.

Corby. A new 15,000 sq ft factory planned for Aquascutum and Assoc. Companies, Nelson Wks, Trafalgar Rd, Kettering.

Crowthorne. D.S.I.R., 5 Regent St, S.W.1, propose new laboratories at Road Research Dept.

Croydon. Factory proposed for F. Watson Ltd., Croydon; architect: E. R. Scratchley, 30 High St, Thornton Heath. Prudential Assurance Co. Ltd. propose showrooms and offices, Wellesley Rd; company's chief surveyor: F. N. Waller, Estate Dept., Holborn Bars, E.C.1.

Devonport. Factory proposed for H. Terry and Sons Ltd.; architects: A. F. French and Ptnrs., Pearl Assurance Hse, Royal Parade, Plymouth.

Doncaster. £60,000 scheme for three-storey block of shops and offices, Reindeer Hotel corner, has been proposed by Town and City Properties Ltd., Kingsbury Hse, King St, S.W.1.

Dover. Contracts arranged soon for modernisation and general conversion of Connaught Barracks for War Office; architect: Gordon Jeeves, 61 Catherine Pl, S.W.1.

Dunston. Newcombe and Newcombe, 23 Eldon Sq, Newcastle, architects for proposed new church for St. Nicholas' Church Council.

Durham. Martin and Felton, Refuge Bldgs, St. Thomas St, Sunderland, appointed quantity surveyors by C.C. for proposed modern schools, Hartlepool West View and West Boldon.

Eastleigh. Proposed by Town and City Properties Ltd., Kingsbury Hse, King St, S.W.1, 28 shops with supermarket, 24 maisonnettes/showrooms/offices on site, Winchester Rd, Chandlers Ford.

Ellesmere Port. 20 acres, Stanlow, reserved for construction of oil terminal for Total Oil Products (G.B.) Ltd., Bush Hse, Aldwych, W.C.2; cost: £250,000.

Elstree. Proposed: £70,000 extensions for Technicrete Ltd., on Barnet By-pass, Boreham Wood; architects: Ronald Ward and Ptnrs., 29 Chesham Pl, S.W.1.

Gateshead. Additions to factory, Team Valley estate, proposed for Kavli Ltd.; contractors: John Jackson and Sons, Corporation St, Newcastle. Warehouse, offices, etc., at Earlsway, Team Valley estate, proposed for Walter Willson Ltd.; contractors: Brims and Co. Ltd., Pondon Bldgs, Newcastle.

Glasgow. Proposed: three three-storey shops, etc., 116-122 Trongate, for the Scottish Metropolitan Property Co. Ltd. C.C. propose 96 dwellings, Carntyne Pl, to be all-electric; City Architect.

Gloucestershire. C.C. propose £172,398 enlargement of Hartbury Farm Institute.

Harlow. Contract placed with W. and C. French Ltd., Epping New Rd, Buckhurst Hill, for 50,000 sq ft extension to factory of A. C. Cossor Ltd.

Harrogate. Proposed: chemical research laboratory and amenity building, Otley Rd, for Tobacco Mnfrs. Standing Com., 6 Bruton St, W.1; contractors: W. G. Birch (Harrogate) Ltd., Montpelier Hse.

Harrow. Contracts placed soon for extensions to cost £125,000 for Sopers of Harrow Ltd., departmental store, Station Rd; architects: Deacon and Laing, 65 Goldington Rd, Bedford.

Haverfordwest. Large store, Bridge St, proposed by Home and Colonial Stores, 179 City Rd, E.C.1.

Hemel Hempstead. New workshops/offices, Maxted Rd, proposed for General Electric Co. Ltd.; architects: Clifford Tee and Gale, Radstock Hse, Eccleston St, S.W.1.

Hereford. Extensions to cost £60,000 proposed for Denco Engineering Services Ltd., Holmer Rd; contractors: Wilson Lovatt and Sons Ltd., Clarence St, Wolverhampton.

Herts. New C.E. school proposed, Woolmer Green; architects: H. G. Cherry and Ptnrs., 38 Portland Pl, W.1.

Hinckley. Leicestershire Building Soc., The Borough, propose four-storey offices/shops, Odeon Cinema and adjoining sites.

Huddersfield. Leeds Regional Hospital Board, Park Parade, Harrogate, to obtain tenders for phase 2 of Lindley Hospital to include second ward block for 285 beds, clinics and staff dining rooms; architects: George, Trew and Dunn, 50 Eastbourne Terr, W.2.

Jarrow. T.C. propose 298 dwellings, Boldon overspill area. Engineer, Town Hall.

Lancaster. An 88,000 sq ft building as extensions to mills is planned for Storey Bros. and Co. Ltd., White Cross Mills.

Liverpool. Kenneth Wakeford, Jerram and Ptnrs., 7 Connaught Pl, W.2, architects for shopping centre between Liverpool Rd North and Northway, for Ravenseft Properties; contractors: Holland & Hannen and Cubitts (G.B.) Ltd., 1 Queen Anne's Gate, S.W.1.

London. Factory, Hawley Cres, N.W.1, proposed to plans by Newman, Levinson and Ptnrs., architects, 9 Mansfield St, W.1. Factory, Stirling Rd, W.3, proposed for F. Townsend and Co. Ltd.; architect: A. S. Bryan, "Whitestocks," Loudwater La, Rickmansworth. 13-storey block planned in reconstruction of departmental store of Dawson Bros. Ltd., City Rd, E.C.1; architects: G. Baines and Syborn, 121 Victoria St, S.W.1. Block of five shops/offices/flats above planned, Hornsey Rd, N.; architect: Ivor Hodges, 10 Gray's Inn Sq, W.C.1. Nine-storey offices planned, Stamford Hill, Stoke Newington, N.; cost: £75,000; plans by Ord, Carmel and Kritzler, 27 Stamford Hill, N.16. Nine-storey office block, Willow Bank, S.W., proposed by Dynamic Property Investments Ltd.; contractors: Geo. Wimpey and Co. Ltd., Hammersmith Gro, W.6; cost: £376,000. Seven-floor showroom/office block planned, 41 Albemarle St, W.1; architect: Peter Moro, 14 Buckingham St, W.C.2. Proposed: seven-storey showrooms/stores/residential accommodation, King St/St. Peter's Gro, Hammersmith, W.6; Sydney Tatchell, Son and Ptnrs., architects, Cliffords Inn, E.C.4.

Luton. Rank Organisation, London, propose bowling centre at a cost of £175,000.

Manchester. A warehouse and offices at Oldham Rd, Ancoats, proposed for F. W. Buckenham Ltd., 110 Oldham Rd; builders: Jones and Rawlinson Ltd., 6 Leaf St, Manchester 6.

Middlesbrough. Elder and Lester, 65 Albert Rd, architects for proposed three-storey offices, Albert Rd, for Temperance Permanent Building Soc.

Morpeth. R.D.C. propose 15 houses, Longhorsley, and also houses at Widde Rington; Surveyor.

Newcastle. Studios and staff rooms proposed by Council of King's College, 1 Devonshire Terr. Planned: Firfield secondary school for C.C.; architects: G. H. Gray and Ptnr., 8 Portland Terr.

Northants. C.C. propose new subdivisional police station, costing £54,000, Wootton Hall estate; also new Council buildings, Angel La, site of present subdivisional station; County Architect.

Pershore. Worcestershire C.C. propose teaching farm school to cost £100,000.

Peterborough. Norwich Union Assurance Co. propose six-storey office block, Corn Exchange site.

Ponteland. Proposed: printing works for C. A. Macdonald Ltd., Shields Rd, Newcastle; contractors: Graham and Son, Forest Hall, Newcastle.

Renfrewshire. The Rootes Group, Ryton-on-Dunsmore, Coventry, placed contract, worth about £2,500,000, for main block of buildings at proposed car factory, Linwood, nr. Paisley; contractors: Melville, Dundas and Whitson Ltd., 21 Blythswood Sq, Glasgow C.2; whole project will cost about £4,000,000.

Rustington. 32 flats to cost £150,000 proposed at Seafield Court; architects: Skinner and Bailey, 74 Queensway, W.2.

Scunthorpe. T.C. propose 216 dwellings, Westcliff estate; cost: £582,287; Surveyor.

Sedgley. Planned: 24 bungalows, Strait estate, for Jenkins (Builders) Ltd., 7 George St, Birmingham 12.

Shipley. Proposed by Metal Box Co. Ltd., Baker St, W.1, machinery building factory on 20-acre site, Dockfield industrial estate, nr. Leeds Rd.

Skipton. 24 dwellings, Homefield Farm, Sutton, proposed by Terry of Bradford Ltd.

Slough. £70,000 contract placed with William Moss and Sons Ltd., North Circular Rd, N.W.2, for extending offices at Petersfield Ave for I.C.I. Ltd.

Southampton. Wessex Regional Hospital Board, Winchester, propose in 1962 major development, in five stages, of Coldeast Hospital. Synagogue at Mordaunt Rd planned by B. H. Dale and Ptnrs., architects, 19 Carlton Cres.

Stockton. Proposed: development of Portrack gun site for industrial purposes, for F. R. Evans Ltd., engineering contractors, Leeds. New laboratory, Parkfield Wks, planned for Power-Gas Corp., Ltd., Stockton.

Stoke. Proposed: £300,000 extension at Kidgrove Wks, nr. Stoke, for English Electric Co. Ltd.; contractors: Taylor Woodrow Construction Ltd., Southall. Site at Old Hall St/Charles St/Gilman St, Hanley, acquired by Shop Development Group, 12 St. George St, W.1, propose development to include shops, supermarket and offices.

MEETINGS TO NOTE

THURSDAY, 14 SEPT.

INSTITUTION OF MECHANICAL ENGINEERS (Eastern Branch). (Lubrication and Wear Group) "Lubricants in Nuclear Reactors." P. E. B. Vaile. Social Club of Hoffmann Manufacturing Co. Ltd., Chelmsford. 7.30 p.m.

A.S.E.E. (Bradford). "Lighting in Home and Industry." J. W. Howell. Midland Hotel. 7.30 p.m.

A.S.E.E. (Nottingham). Chairman's address, People's College of Further Education, Castle Rd. 7.30 p.m.

A.S.E.E. (S.W. London). "Unearthing London." Norman Cook. Prince of Wales Hotel, S.W.19. 8 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Liverpool). Chairman's address. "Instruments in the Phosphate Industry." D. G. Tate. M.A.N.W.E.B. Industrial Centre, Paradise St. 7 p.m.

INSTITUTION OF PLANT ENGINEERS (Glasgow). "Electronic Control of Machine Tools and Production Plant." Scottish Bldg. Centre, 425 Sauchiehall St, Glasgow C.2. 7.15 p.m.

FRIDAY, 15 SEPT.

A.S.E.E. (Stoke and Crewe). "Electronic Controls and Photo-electric Equipment." G. I. G. Ive. Grand Hotel, Hanley. 7.30 p.m.

MONDAY, 18 SEPT.

SOCIETY OF INSTRUMENT TECHNOLOGY (Bristol). "Telemetry Installation in Bluebird, 1960." A. Potten. Dept. of Physics, University of Bristol, The Royal Fort. 7.30 p.m.

A.S.E.E. (Bristol and West). Chairman's address and "Trends in Technical Education." E. J. Mathieson. Grand Hotel, 8 p.m.

A.S.E.E. (Mid-Essex). "The A.S.E.E.: Its Work and Its Future." E. A. Bromfield. White Hart Hotel, Tindall St, Chelmsford. 7.45 p.m.

BIRMINGHAM ELECTRIC CLUB. Presidential address, "Power Cables." A. R. Leigh. Grand Hotel. 5.30 p.m.

TUESDAY, 19 SEPT.

A.S.E.E. (Leicester). "Subscriber Trunk Dialling." C. G. Lloyd. Westcotes Constitutional Club, 124 Wilberforce Rd. 7.30 p.m.

A.S.E.E. (Oxford and Districts). "Present-day Applications and Recent Developments in Water Heating." The Board Room, Employment Exchange, St. Aldates. 7.30 p.m.

I.E.S. (Stoke-on-Trent Gp.). "The I.E.S. Code." P. Hartill and G. O. Edwards. North Stafford Hotel. 6.30 p.m.

A.S.E.E. (York). "Electric Floor-warming." R. Bradbury. Royal Station Hotel. 7.30 p.m.

THURSDAY, 21 SEPT.

SOCIETY OF INSTRUMENT TECHNOLOGY (Grangemouth). "Theoretical Aspects of Control Engineering." J. M. Keating. Leapark Hotel, Bo'ness Rd. 7 p.m.

MONDAY, 25 SEPT.

INSTITUTION OF PLANT ENGINEERS (W. and E. Yorks). "The Construction of Bradwell Heat Exchangers." J. Shaw and G. Cain. Houldsworth School of Applied Science, Leeds University. 7.30 p.m.

I.E.S. (Birmingham Centre). Chairman's address, S. C. Dinenage, Chamber of Commerce, 75 Harborne Rd, Edgbaston, Birmingham 15. 6.30 p.m.

TUESDAY, 26 SEPT.

BRITISH INSTITUTION OF RADIO ENGINEERS (Southern Section). Chairman's address. "Lightning—Facts and Fancies." W. A. Gambling. Technical College, Farnborough. 7 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY. "Underground Gasification of Coal—Some Features of Instrumentation." Dr A. E. Balfour. "Trends in Mining Instrumentation." A. E. Bennett. Manson Hse, 26 Portland Pl, W.1. 6.30 p.m.

I.E.S. (Leicester Centre). Chairman's address, H. R. Ruff. Demontration Theatre, East Midlands EB. Charles St. 6.15 p.m.

WEDNESDAY, 27 SEPT.

BRITISH INSTITUTION OF RADIO ENGINEERS (Education and Training Committee). Symposium: "The New Graduateship Syllabus and the Institution's Recommendations for Practical Training." University College, W.C.1. 10.30 a.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Television Group). "Some Recent Developments in Television Tape Recording." P. E. Axon, K. Machein, A. Harris. London School of Hygiene and Tropical Medicine, Keppel St, Gower St, W.C.1. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (West Midlands Section). "The Single Crystal Circuit." D. H. Roberts, College of Technology, Wolverhampton. 7.15 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Yorks). One day symposium, "New Techniques in Primary Measuring Methods." Kenwood Hall, Sheffield 7.

SOCIETY OF INSTRUMENT TECHNOLOGY (S. Wales). "Analytical Instruments for Process Control." E. J. West. Welsh College of Advanced Technology, Cathays Pk, Cardiff. 6.45 p.m.

BRITISH CONFERENCE ON AUTOMATION AND COMPUTATION. "Mathematics—Friend or Foe?" Dr D. G. Christopherson. I.E.E., Savoy Pl, W.C.2. 5.30 p.m.

THURSDAY, 28 SEPT.

SOCIETY OF INSTRUMENT TECHNOLOGY (Chester). "Our Technology and Our Society." G. C. Elteton. Stanley Palace, Watergate St. 7 p.m.

PURCHASING OFFICERS' ASSOCIATION. "Minibition" at Brighton until 30 Sept.

INSTITUTION OF PLANT ENGINEERS (Sheffield). "Industrial Relations." W. Carron. Grand Hotel. 7.30 p.m

Gazette Announcements

COMPANIES ACTS

Advance Domestic Appliances Ltd. Meetings of members and creditors to be held at 9 Philpot La, E.C.3, on 5 Oct., at 2.30 and 2.45 p.m., respectively, for the purpose of receiving an account of the winding-up.

Allray Electrical Eng. Co. Ltd. Petition for winding-up to be heard before the County Court of Cardiff, Government Bldgs, Westgate St, Cardiff, on 19 Oct. Persons intending to appear to notify Needham and James, 380 Stratford Rd, Sparkhill, Birmingham 11, by 4 p.m., 18 Oct.

Audiovision (Electrical) Ltd. Mr S. J. Baker, 26-28 Finsbury Sq, E.C.2, appointed liquidator at extraordinary general meeting on 22 Aug. for the purpose of voluntarily winding-up.

Better Housekeeping Appliances (Southampton) Ltd. Mr G. E. Radford, 12 Portland St, Southampton, appointed liquidator as from 6 July.

Hilderthorpe Electrical Supplies Ltd. Meeting of creditors to be held at offices of Armitage and Co., Brotherton Chmbrs, Westgate, Leeds 1, on 15 Sept., at 2.30 p.m.

Michael Neidle Ltd. Mr C. V. Shaw, 46 Blandford St, W.1, appointed liquidator at extraordinary general meeting on 25 Aug. for the purpose of voluntarily winding-up.

Neptric Ltd. and **Nortic Electrical Ltd.** Mr G. A. Weiss, 19 Eastcheap, E.C.3, appointed liquidator at extraordinary general meeting on 28 Aug. for the purpose of voluntarily winding-up.

Peto Scott Electrical Instruments Ltd. Dividend per £: 2s 6d, payable at W. H. Cork, Gully and Co., 19 Eastcheap, E.C.3, on 15 Sept.

Universal Cooler Ltd. Mr J. A. Oliver, Coventry Hse, South Pl, E.C.2, appointed liquidator at extraordinary general meeting on 23 Aug. for the purpose of voluntarily winding-up. The subsequent meeting of creditors appointed Mr H. W. Pitt, 100 Park St, W.1, as joint liquidator.

Warden Electrics Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 9 Oct. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, E.C.2, by 4 p.m., 6 Oct.

William J. Hook and Co. Ltd. Mr M. G. R. Keeling, 45 Green Lanes, N.13, appointed liquidator at extraordinary general meeting on 26 Aug. for the purpose of voluntarily winding-up.

BANKRUPTCY ACTS

Receiving Orders

Barrow-in-Furness and Ulverston. F. Whittall, electrical dealer, of 25 Collingwood St, Barrow-in-Furness. Receiving order dated 30 Aug.

Liverpool. T. Cohen, furniture and electrical dealer, formerly carrying on business as Peco Electrics at 78 Stanley Rd, Bootle. Receiving order dated 28 Aug.

Northampton. S and E Electrical, electrical dealers, formerly carrying on business at 23 Greyfriars St. Receiving order dated 30 Aug.

Appointment of Trustees

Hanley and Stoke-on-Trent. L. T. Thornton and T. Hollingworth, electrical appliance retailers and house furnishers, formerly carrying on business as Electrical Homes (S-o-T.) at 7 Glebe St, B.R.S. Depot, Whieldon Rd, Fenton, Stoke-on-Trent, and at 194 Liverpool Rd, Newcastle under Lyme, and 24 St. Anne St and 11a Chapel La, Chester. Mr P. J. Snow, 17 Albion St, Hanley, appointed trustee as from 23 Aug.

Nottingham. H. E. Turner, radio, television and electrical engineer and retailer, formerly carrying on business at 26 Outram St, Sutton-in-Ashfield, Mr. C. E. Turton, 91 Talbot St, Nottingham, appointed trustee as from 10 Aug.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

A. C. Hayes Ltd., 117 Hagley Rd, Birmingham 16. Electrical engineers, manufacturers of and dealers in dynamos, motors, etc. Nom. cap.: £1,000. Dirs.: Albert C. Hayes and Samuel H. McCormick.

Camborne Electrical (Sew-Vac) Ltd., 14 Commercial St, Camborne, Cornwall. Nom. cap.: £100. Dirs.: Thos. M. Harry and Mrs Elizabeth U. Harry.

Cooper and Muir Ltd., 164 Bishopsgate, E.C.2. Manufacturers and designers of electrically operated heating panels and other forms of space heating, etc. Nom. cap.: £100. Dirs.: Royston Cooper and Marjorie Muir.

D.A.C. Supplies Ltd. To deal in furniture, electrical appliances, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: Patricia A. B. Faloon, 6 Bethany St, Belfast; and Caroline M. Tyler, 68 Bridge End, Belfast.

Duomatic Heating Installations Ltd., 324 Gray's Inn Rd, W.C.1. Central heating engineers, etc. Nom. cap.: £100. Dirs.: James F. Elvins, Wm. J. Hanley, Michael P. Cosgrave and Reginald G. Stokes.

Earlsdon Electrical Services Ltd., 176 Albany Rd, Coventry. Nom. cap.: £100. Dirs.: Barnard Ward and Wm. Ward.

Fife (Electronic Accessories) Ltd., 47 Pilgrim St, Newcastle upon Tyne. Nom. cap.: £5,000. Dirs.: Mrs Joyce S. K. Taylor, William A. Hogarth and John S. Nelson.

Kenmore (Parts) Ltd., Maxwell Hse, Arundel St, W.C.2. Importers, exporters, manufacturers of and dealers in engineering and electrical parts, etc. Nom. cap.: £500. Dirs.: not named. Subs.: Hugh R. Fortescue and Stephen E. D. Fortescue.

L. J. Portlock Ltd., 355 High St, Chatham, Kent. Manufacturers of and dealers in electrical and mechanical apparatus, etc. Nom. cap.: £1,000. Dirs.: Leonard J. Portlock and Mrs I. H. Portlock.

Promet (Sales) Ltd., 194 Bishopsgate, E.C.2. Electrical goods dealers, etc. Nom. cap.: £100. Dirs.: Joseph Golding and Miss Charlesina Buckmaster.

Thomasson Bros. Ltd. To take over the business of radio, television and electrical dealers carried on as "Thomasson Bros." at 298 Chorley Old Rd, Bolton, Lancs, etc. Nom. cap.: £5,000. Dirs.: Cyril Thomasson and Elsie Thomasson.

T.R. (Electrics) Ltd., 10 Park Sq, Leeds 1. Nom. cap.: £500. Dirs.: Mary Heaton and Thomas Rogers.

W. R. Hammond and Son Ltd., Mill St, Eynsham, Oxford. Electrical, radio, television and general engineers, etc. Nom. cap.: £1,000. Dirs.: William R. Hammond, Doris E. Hammond and David Hammond.

W. Wall (Electrical) Ltd., Walnut St, Halifax. Nom. cap.: £2,000. Dir.: William Wall.

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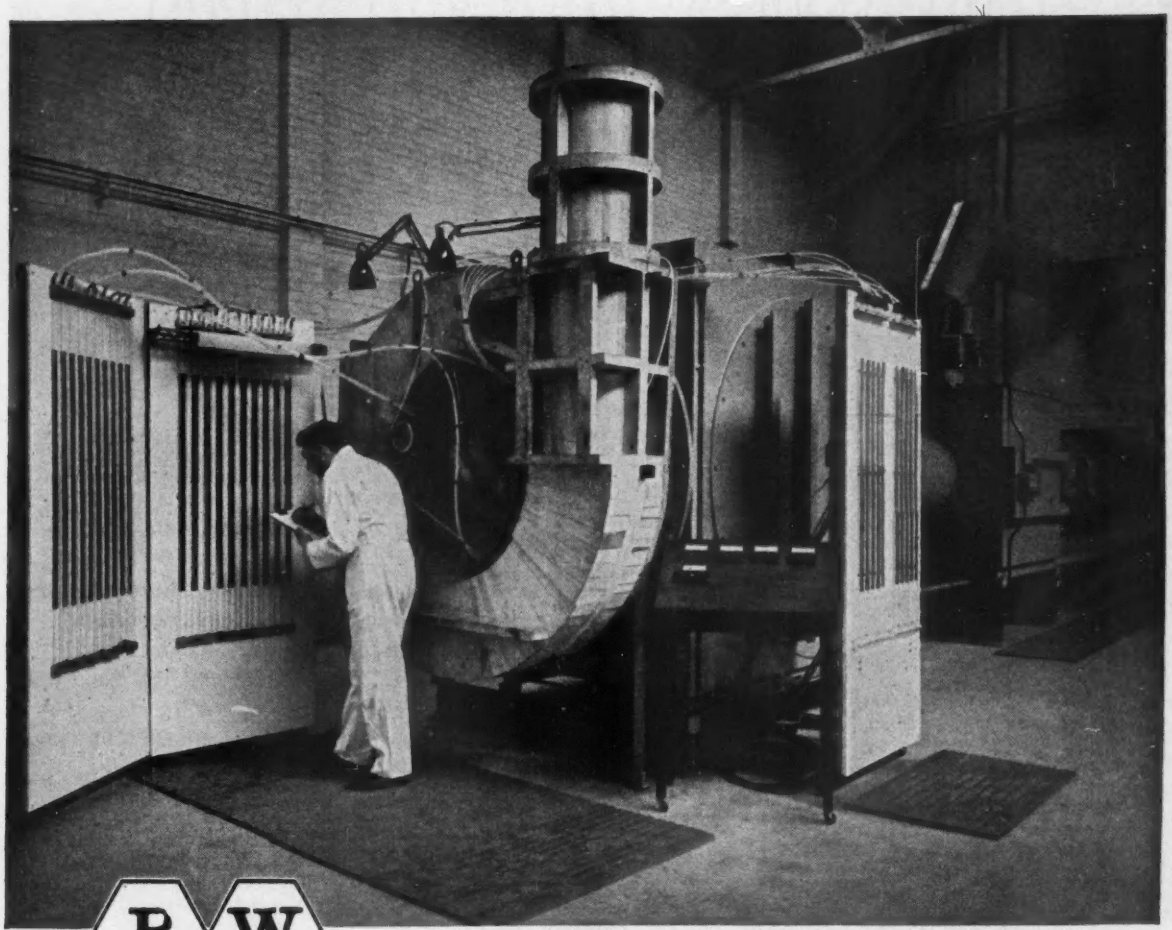
It is this outlook that has enabled us to provide new answers to many problems in mechanical engineering, from turbo-machinery to sea-water distillation plant.



R W G

In the Aerodynamics Laboratory of the Richardsons Westgarth Group, an engineer tests an air flow model of the outlet diffuser and volute assembly for a high-speed centrifugal compressor. These volutes and diffusers will be used on a number of gas turbo-compressors at present being manufactured for a well-known Oil Company.

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IC/124

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

CITY OF MANCHESTER

TENDERS invited for the Renewal and Reinforcement of Electrical Installation in the Police Headquarters, Manchester. Specification and drawings from City Architect, P.O. Box 488, Town Hall. Tenders returnable by 2 Oct., 1961. (C 118)

APPOINTMENTS VACANT

SOUTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER

(DRAWING OFFICE)

CHIEF ENGINEER'S DEPARTMENT

HEAD OFFICE, BRISTOL

SALARY within Class J, Grade 10, Salary Scale 8, £970/£1,165 per annum of the N.J.B. Agreement.

The successful candidate will be responsible for the preparation of drawings and estimates of civil works in connection with indoor and outdoor H.V. substations.

He should have experience in the taking off, abstracting and billing of quantities, have a working knowledge of reinforced concrete design and be fully conversant with up-to-date building construction.

He will also be responsible for the training of apprentices as and when they become attached to the Section.

Applicants should be in possession of the Higher National Certificate in Building Construction or qualifications leading thereto.

Applications for this post to be made on Standard Form AE6/ACT OBTAINABLE BY POSTCARD ONLY from the Establishments Officer, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1. Closing date for receipt of completed applications is 30 Sept., 1961. (C 104)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. Schedule A appointments in the South Wales Division:

ASSISTANT MAINTENANCE ENGINEER

(ELECTRICAL)

TIR JOHN POWER STATION

SWANSEA, GLAM

Vacancy No. 259/ET/61.

Salary: Class H, Grade 9, Scale 8, £1,040/£1,165 per annum.

Applicants should possess H.N.C. or equivalent qualifications and should have had wide experience in power station electrical maintenance.

STATION SHIFT CONTROL ENGINEER

LLANELLY POWER STATION, CARMS

Vacancy No. 260/ET/61.

Salary: Class E, Grade 10, Scale 4, £765/£870 per annum, plus £90 shift allowance.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a power station.

Special application forms obtainable from Divisional Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 30 Sept., 1961. (C 117)

GOVERNMENT OF ADEN

Public Works Department

ELECTRICAL AND MECHANICAL ENGINEER

QUALIFICATIONS: Candidates must be A.M.I.Mech.E. or A.M.I.E.E. with seven years' experience in general engineering works.

Duties: The maintenance of all mechanical and electrical plant in the Public Works Department. Erection and commissioning of new plant and equipment.

Terms of Appointment: Contract for 18-24 months.

Total emoluments (salary and gratuity): in scale £2,069/£2,710. Children's allowances. Free passages. Outfit allowance. Married quarters available at moderate rental.

Apply Director of Recruitment, Department of Technical Co-operation, Carlton Hse Terr, London S.W.1, giving full name, age and brief particulars of qualifications and experience, quoting RC.210/1/01/D10. (C 77)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Glasgow Area

APPLICATIONS are invited from suitably qualified Engineers for the following superannuable appointment:

ASSISTANT ENGINEER

Candidates should have experience in preparing specifications and estimates for power, heating and lighting installations.

Duties will include the charge of a small squad of maintenance electricians and mechanical fitters, and experience in the running of small maintenance workshop is desirable.

Salary applicable to Third Assistant Engineers, viz.: £1,190/£1,325 per annum in accordance with Class L, Grade 10 (Scale 10) of the N.J.B. Salary Scale.

The successful candidate shall be required to reside within reasonable travelling distance of Area Headquarters.

Applications, quoting Ref. No. GE/60/61, should be submitted on the standard application form which is obtainable from the Area Secretary, P.O. Box 6, 75 Waterloo St, Glasgow C.2, and should be returned not later than Monday, 25 Sept., 1961. (C 96)

CIVIL SERVICE COMMISSION

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women for work on the examination of Patent applications. Age at least 20 and under 29 (36 for Examiners) on 31 Dec., 1961, with extension for regular Forces service and Overseas Civil Service. Qualifications: normally a degree, or a Diploma in Technology, with first or second-class honours in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C., A.Inst.P. Inner London salary £793/£1,719; provision for starting pay above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting S/128/61, and stating date of birth. (C 83)

THE NORTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER

PLANNING AND DESIGN SECTION

AREA BOARD HEADQUARTERS

MANCHESTER

APPLICANTS must have had experience in distribution work up to and including 33 kV and, in particular, on the design, layout and construction of 33 kV substations, including plant and ancillary equipment.

The minimum technical qualification required is the Higher National Certificate or equivalent in Electrical Engineering.

Salary scale: £1,415/£1,720 p.a. Grade K.5. N.J.B. Conditions.

Applications on forms to be obtained from the Secretary, The North Western Electricity Board, Cheetwood Rd, Manchester 8, and returned to him by 25 Sept., 1961.

DISTRICT SENIOR CLERK

BURY DISTRICT

The person appointed will be responsible for the supervision of all clerical functions in the District. Applicants should have had experience in secretarial practice, meter reading, costing, invoices, stores, salaries, wages and conditions of service, correspondence and general office routine and in dealing with consumers' inquiries, records and accounts.

Salary scale: £1,150/£1,240 p.a. Grade 6. N.J.C. Conditions.

SENIOR ASSISTANT

(SALES SUPERINTENDENT)

BOLTON DISTRICT

Applicants should have a sound commercial background, including a thorough knowledge of up-to-date sales promotion methods.

The successful candidate must be capable of organising sales campaigns including direct mail, exhibitions, demonstrations, etc.

Dutes will include the supervision of four service centres, demonstrators, sales representatives and the control of stock. Ability to develop business is essential and preference will be given to applicants with technical qualifications. The appointment will date from early December and following the retirement of the present holder of the post.

Salary scale: £1,150/£1,240 p.a. Grade 6. N.J.C. Conditions.

Applications on forms to be obtained from the Manager, No. 2 Sub-Area, The North Western Electricity Board, 2 St. George's Rd, Bolton, and returned to him by 25 Sept., 1961.

THIRD ASSISTANT DISTRICT ENGINEER

PRESTON DISTRICT

Duties will include the operation, maintenance and construction of underground and overhead mains and substations, and general distribution work.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale: £1,040/£1,165 p.a. Grade H.9. N.J.B. Conditions.

SUB-AREA SENIOR DEMONSTRATOR

PRESTON

Applicants must have had a good education with training in Domestic Science, and should hold the E.A.W. Diploma. The person appointed will be required to give lectures and demonstrations on all types of domestic appliances, advise consumers on the choice of equipment. and must be capable of supervising staff and arranging the training and electrical education of new entrants up to E.A.W. Diploma standard.

Salary scale: £780 x £25—£880 p.a. Grade 3. N.J.C. Conditions.

Applications on forms to be obtained from the Manager, No. 4 Sub-Area, The North Western Electricity Board, 40-41 Lune St, Preston, and returned to him by 25 Sept., 1961. (C 89)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

ASSISTANT PLANNING ENGINEER

STAYTHORPE "A" AND "B" POWER STATIONS

Vacancy No. 210/61.

APPLICATIONS are invited for the position of Assistant Planning Engineer at Staythorpe "A" and "B" Power Stations, near Newark, Notts.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are corporate members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 8 (£1,440/£1,610 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 29 Sept., 1961.

ASSISTANT INSTRUMENT ENGINEER

STAYTHORPE "A" AND "B" POWER STATIONS

Vacancy No. 211/61.

Applications are invited for the position of Assistant Instrument Engineer at Staythorpe "A" and "B" Power Stations, near Newark, Notts.

Applicants should have had sound training and wide experience in instrument making and/or repair. Preference will be given to candidates with knowledge of electronic and other modern forms of instrumentation and complex control systems as encountered in modern power stations or other large industrial organisations.

Salary will be in accordance with Class M, Grade 9 (£1,350/£1,500 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 29 Sept., 1961.

These appointments are pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent and should be returned to him by the date stated.

O. S. WOODS,
Assistant Regional Director.
(C 107)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

THIRD ASSISTANT ENGINEER

(OVERHEAD LINES)

APPLICATIONS are invited for the position of Third Assistant Engineer (Overhead Lines) in the Transmission Project Branch of the Regional Electrical Department based on Leeds.

The successful applicant will be required to supervise the work of Contractors engaged on the erection of main transmission overhead lines at 132 kV and 275 kV operation. Interesting work in the development of the 400 kV system is due to commence shortly.

Previous experience in all aspects of the setting out and erection of lattice steel tower lines is essential.

Preference will be given to candidates who possess, or are completing qualifications leading to Corporate Membership of an appropriate professional engineering institution.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Grade 8, Class K (£1,145/£1,410 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 29 Sept., 1961. (C 81)

SOUTHERN ELECTRICITY BOARD

BRANCH COMMERCIAL SUPERINTENDENT

MELKSHAM District of No. 2 (Newbury) Sub-Area, located at Devizes. Salary: N.J.B. Class G, Grade 8 (£1,040/£1,165 per annum). N.J.B. Conditions of Service.

Applicants should be qualified to accept responsibility within the Branch for all commercial matters including development, installations and the application of tariffs.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1388, not later than 25 Sept., 1961.

ASSISTANT ENGINEER

(MAINTENANCE AND OPERATION)

Uxbridge District of No. 1 (Southall) Sub-Area. Salary: N.J.B. Class G, Grade 9 (£965/£1,090 per annum, plus £50 per annum London Allowance). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, cables and overhead lines up to and including 11 kV. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1404, not later than 25 Sept., 1961.

INSTALLATION ENGINEER

Chichester District of No. 3 (Portsmouth) Sub-Area. Salary: N.J.B. Class F, Grade 8 (£965/£1,090 per annum). N.J.B. Conditions of Service.

Applicants should be qualified to organise and control all installation and maintenance work in the District and Branches and to collaborate with the Development Engineer and District Commercial Engineer in the preparation of contracting schemes of a large or exceptional nature.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1403, not later than 25 Sept., 1961.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (C 101)

LONDON ELECTRICITY BOARD

ASSISTANT COMMERCIAL ENGINEER

APPLICATIONS are invited for the above position in the Board's South Western District at 204 Lavender Hill, S.W.11.

Applicants should possess a sound technical knowledge and be thoroughly experienced in all types of wiring installations and consumers' apparatus. Experience in voltage changeover work would be an advantage.

The successful candidate may be required to prepare specifications, estimates and tenders for all classes of electrical installations, to carry out negotiations in connection with voltage changeover, and to supervise specific projects as required.

The post is graded under Schedule "A" of the National Joint Board Agreement as Class K, Grade 10, £1,165 per annum, rising to £1,295 per annum, inclusive of London Allowance.

Applications, stating age and experience, should be sent to the Manager at the above address, within 14 days of the publication date of this notice. Please quote Ref.: PER/V/3378/T. (C 105)

CENTRAL ELECTRICITY GENERATING BOARD

Planning for Electricity Supply

ASSISTANT ENGINEERS

ARE required in the System Planning Branch of the Planning Department at Headquarters, London S.E.1.

The System Planning Branch is responsible for the initiation and co-ordination of programmes of new generating plant and main transmission. The work of the branch includes statistical analysis of the growth of electricity demand and the preparation

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of estimating data for forward planning, study of the technical and economic considerations in the deployment of new generating capacity and in fashioning the pattern of power and energy movement, analysis of system performance to aid reliability in forward planning, and preparation and reporting to management of comprehensive plans for development of the power system as an entity.

Candidates should have an aptitude for clear and imaginative thinking, and the ability to express themselves clearly and concisely. Experience gained within a large interconnected electricity supply system would be an advantage but is not essential. Further advantages would be a knowledge of engineering economics or experience in the application of digital computing techniques to scientific problems. Technical qualifications at least equivalent to Graduate Membership of the Institution of Electrical Engineers are expected and a degree of a British University would be an advantage.

Salaries on scales within the range £930/£1,890 p.a., according to duties and responsibilities.

Applications stating age, qualifications, experience, present position and salary to the Appointments Officer, 24/30 Holborn, London E.C.1, by 18 Sept.

Envelopes should be marked "Confidential Ref. ET/417." (C 84)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

CONSUMERS' ENGINEER

REQUIRED in the Anglesey District, based on Holyhead.

Salary within the range £890/£1,015 per annum (N.J.B. E.8, Scale 6).

Applicants must have had a sound technical training and experience within the Industry in dealing with:

(a) designing and estimating for all types of electrical installation work;

(b) advising consumers on tariffs, appliances and all aspects of electricity utilisation;

(c) organisation of Service Centres and exhibitions;

(d) control of manual and administrative staff.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, nr. Wrexham.

Closing date 29 Sept., 1961. (C 93)

LONDON ELECTRICITY BOARD

ASSISTANT COMMERCIAL ENGINEER

APPLICATIONS are invited for the above position in the Commercial Department of the Board's West Bourne District at 20 Victoria Gdns, W.11.

Applicants should possess a sound technical knowledge and be thoroughly conversant with modern practice in the installation, repair and maintenance of electrical equipment in buildings.

The successful candidate will be responsible for the supervision of personnel engaged on consumer service and contracting work on consumers' premises and will, in addition, be expected to prepare specifications, estimates and tenders for all classes of electrical installations.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 8, £1,240 per annum, rising to £1,375 per annum, inclusive of London Allowance.

Applications stating age and experience should be sent to the Manager, West Bourne District, 63-81 Pelham St. S.W.7, within 14 days of the publication date of this notice. Please quote ref.: PER/V/3383/T. (C 112)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

FOURTH ASSISTANT ENGINEER

(PROGRAMMES AND PROGRESS)

APPLICATIONS are invited for the above position in the Transmission Project Branch of the Regional Electrical Department based on Leeds.

The successful applicant will be required to assist in the Programming and Progressing of Transmission reinforcement schemes within the Region. The work is of an interesting and varied nature involving close contact with each successive stage from inception to final commissioning and including estimation of costs, incidence of expenditure and budget control.

The section is a new one and there is scope for the introduction of original ideas.

Candidates should possess or be completing qualifications leading to Corporate Membership of the I.E.E.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Grade 9, Class K (£1,050/£1,325 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 29 Sept., 1961. (C 80)

LONDON ELECTRICITY BOARD

SENIOR DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Board's Southern District at 54 Bengeworth Rd, London S.E.5.

Applicants should have had a good general and technical education and possess the Ordinary National Certificate or its equivalent and be capable of supervising Engineering Draughtsmen and other Drawing Office staff. They should also have had experience in building construction including reinforced concrete design, be able to prepare working drawings and structural calculations in connection with the conversion of existing premises into transformer chambers, together with the layout of electrical equipment and cabling.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 10, £1,090/£1,215 per annum, inclusive of London Allowance.

Applications stating age, qualifications and experience, should be sent direct to the Manager at 54 Bengeworth Rd, S.E.5, within 14 days of the publication date of this notice. Please quote ref. PER/V/3327/T. (C 86)

MIDLANDS ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT ENGINEER

REQUIRED in the Dudley District of the South Staffs and North Worcs Area.

Applicants should have had experience in all branches of district work including the installation, operation and maintenance of high and low voltage cables, switchgear and transformers. Technical qualifications desirable.

Salary: £1,190/£1,325 per annum (N.J.B. Grade H.7). Superannuable.

Apply, by letter, within ten days, stating age, qualifications, experience, present position and salary, to Mr D. Holt, Acting Area Manager (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

F. W. CATER,
Secretary.
(C 92)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

SECTION ENGINEER

REQUIRED at Aberystwyth in the Board's No. 4 Sub-Area.

Salary within the range £965/£1,090 per annum (N.J.B. E7, Scale 7).

Applicants should have had experience in the construction, operation and maintenance of overhead and underground high- and medium-voltage networks with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application froms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhosteyllen, near Wrexham.

Closing date 29 Sept., 1961. (C 94)

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region

THIRD ASSISTANT ENGINEER

ELECTRICAL DEPARTMENT

TRANSMISSION SECTION

GENERATION HOUSE

Vacancy No. 61/550.

APPLICATIONS are invited for this superannuable post which is vacant in the North Section. Candidates should preferably be Corporate Members of the I.E.E. or hold equivalent qualifications, and should have had considerable experience in the operation and maintenance of high-voltage overhead lines and cables, switchgear (oil-filled and air-blast) and transformers. They must also have good knowledge of the Board's safety rules and experience in the control of both technical and manual staff and be familiar with the Board's negotiating machinery.

Salary: N.J.B. Schedule A, Class K (Division), Grade 8, £1,195/£1,460 per annum.

FOURTH ASSISTANT ENGINEER

ELECTRICAL DEPARTMENT

TRANSMISSION SECTION

GENERATION HOUSE

Vacancy No. 61/551.

Applications are invited for the above superannuable post. Candidates should have a sound technical training, preferably with qualifications leading to Corporate Membership of the I.E.E. and experience in the maintenance of high-voltage switchgear, transformers, lines and cables. With the expected growth of the Grid System in the London Area, these positions offer great opportunities for experience in transmission practice to the highest voltages.

Salary: N.J.B. Schedule A, Class K (Division), Grade 11, £950/£1,215 per annum.

Applications, quoting Vacancy No., may be made to (or on form from) Personnel Department, Central Electricity Generating Board, P.O. Box No. 136, London W.1. To be received not later than 26 Sept., 1961. (C 88)

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Nechells "A" and "B" Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K8, £1,275/£1,410 per annum, plus 10% for shift duties.

A sound technical training and practical experience in a power station are required. Appropriate technical qualifications desirable.

Apply, quoting Vacancy No. 240/61 MD, on form AE6, available from the Station Superintendent, Nechells Power Station, Off Aston Church Rd, Nechells, Birmingham 7, to whom they should be returned when completed not later than 25 Sept., 1961. (C 87)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Region

Research and Development Department

ELECTRICAL ENGINEER

APPLICATIONS are invited for the above post based on Laboratories at Portishead, 10 miles west of Bristol. Investigations will sometimes be carried out on the Board's generating and transmission plant within the Region (which includes S. Wales).

Applicants should be experienced in one or more of the following fields: power generation or transmission, electronic circuits and design, measurement of physical quantities by electrical means. The ability to develop instruments or apparatus from the feasibility study to a fully engineered prototype suitable for final installation is desirable.

Qualifications leading to Corporate Membership of a senior professional institution are expected although H.N.C. or equivalent may be acceptable, depending on proved ability.

The salary for the above post is within the following range: £1,050/£1,500.

The successful candidate can be assured of excellent career prospects within the Board's Research and Development Departments and every facility is given to publish technical and scientific papers. Some financial assistance may be given with housing.

Applications on form AE6/ACT obtainable from the Regional Secretary, Central Electricity Generating Board, South Western Region, 1 Eaton Crescent, Clifton, Bristol 8, should be completed and returned by Friday, 22 Sept., 1961, quoting the specific post for which consideration is requested. (C 82)

Eastern Electricity

Essex Sub-Area

197/61.R.

THIRD ASSISTANT ENGINEER

(PLANNING AND DEVELOPMENT)

SUB-AREA HEADQUARTERS

THE work involves assistance in planning of schemes up to and including 33 kV. A good background of technical training in distribution together with technical qualifications and some knowledge of the preparation of switchgear specifications is desirable.

The position offers an excellent opportunity for obtaining experience over a wide field of planning work.

Salary: N.J.B. Class M, Grade 10 (£1,325/£1,460) inclusive of London allowance.

Apply by letter to C. C. Brazier, A.M.I.E.E., Engineer, Essex Sub-Area, Eastern Electricity Board, Millfield, Bentley, near Brentwood, Essex, by 29 Sept., 1961.

Northmet Sub-Area

198/61.R.

GENERAL ASSISTANT ENGINEER

(SENIOR DRAUGHTSMAN)

CIVIL ENGINEERING AND BUILDING

SECTION, SUB-AREA ENGINEER'S

DEPARTMENT (REFERENCE 1083)

The successful candidate will be responsible for the preparation of drawings, for building and civil engineering work for offices, showrooms, workshops, 11 kV and 33 kV substations, etc. and should be capable of carrying out site surveys and supervising drawing office staff.

Possession of the Ordinary National Certificate (Building) or equivalent qualification will be an advantage.

Salary: N.J.B. Class N, Grade 15 (£1,015/£1,140), inclusive of London allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet Hse, Southgate, London N.14, by 29 Sept., 1961. (C 97)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

West Midlands Division

APPLICATIONS are invited for the appointment of

POWER STATION SUPERINTENDENT

Drakelow "A," "B" and "C" Power Stations, nr. Burton-on-Trent. Salary in accordance with the N.J.M. Agreement, Scale G.6, £3,270/£3,515 per annum.

Candidates must have considerable experience in the administration, operation and maintenance problems of a large modern power station.

Preference will be given to applicants holding a University Degree in Engineering or corporate members of the Institution of Electrical or Mechanical Engineers.

Applications should be made in writing, quoting Vacancy No. 242/61 MD, to the Regional Personnel Officer, Regional Headquarters, 53 Wake Green Rd, Birmingham 13, by 29 Sept., 1961. (C 102)

SOUTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of

SUB-AREA ENGINEER

in the Kent Sub-Area. The sub-area headquarters are at Rochester, Kent. Salary: £2,595/£2,815 per annum, in accordance with Grade 6, Class D of the N.J.M. and H.E. scales. Superannuable. Corporate membership of the I.E.E. is desirable and candidates must have had a wide experience of all aspects of electricity supply distribution as well as ability to control staff and organise work on a large scale. The Kent Sub-Area covers an area of 1,010 sq miles and comprises several dense urban districts associated with large industrial supplies, and an extensive rural network.

Applications, quoting ET and naming two referees, to Kent Manager, 178 High St, Rochester, Kent, by 27 Sept., 1961.

METER TESTER

MID-SUSSEX HEADQUARTERS

Wages: 5s 6½d per hour for 42-hour 5-day week under the N.J.I.C. Agreement. Candidates should have served a recognised apprenticeship or a period of training and have had experience in the testing of single and polyphase A.C. meters, summation metering equipments and indicating and recording instruments. Location of appointment will be at the Mid-Sussex Central Meter Depot, North Rd, Brighton.

Applications, quoting ET and naming two referees, to the Mid-Sussex Manager, Mid-Sussex Hse, North Rd, Brighton, by 25 Sept., 1961.

GEORGE WRAY,
Secretary.
(C 100)

J. & P.

SALES ENGINEER

required in London.

Johnson & Phillips Ltd. have a vacancy at their London Office for an Engineer to handle the sales of switchgear, transformers, capacitors and cables. This is a permanent and responsible appointment with scope for advancement. A car will be provided.

Chartered Electrical Engineers or men with H.N.C. in electrical engineering are invited to apply, giving details of experience and training to:

The Employment Manager,
Johnson & Phillips Ltd.,
Charlton, London S.E.7.

(C 121)

THE SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following positions:

Monmouthshire and Mid-Wales Area

(a) ASSISTANT COMMERCIAL ENGINEER

WEST MONMOUTHSHIRE DISTRICT

(BARGOED)

(Reference 76/61/ET). (Re-advertised)

(b) GENERAL ASSISTANT ENGINEER

WEST MONMOUTHSHIRE DISTRICT

(EBBW VALE)

(Reference 111/61/ET)

Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary for both positions: N.J.B. Class H, Grade 11, Scale 6, £890/£1,015 per annum.

Applications stating age, present position, present salary, qualifications, experience and endorsing envelope with the appropriate reference, should be addressed to W. E. Richardson, M.I.E.E., Manager, Monmouthshire and Mid-Wales Area, Llywelyn Rd, Cwmbran, to arrive not later than 30 Sept., 1961.

Previous applicants for the post of Assistant Commercial Engineer need not re-apply as their applications will be considered.

Swansea and West Central Area

(c) FOURTH ASSISTANT ENGINEER

(SUBSTATIONS)

SWANSEA AND WEST CENTRAL AREA

AT PRESENT LOCATED AT PONTARDULAIS

(NINE MILES FROM SWANSEA)

(Reference 112/61/ET)

The duties are of a general nature including mains and substations work. Preference will be given to engineers possessing the Higher National Certificate in Electrical Engineering.

Salary: N.J.B. Class L, Grade 13, Scale 7, £965/£1,090 per annum.

Applications stating age, present position, present salary, qualifications, experience and endorsing envelope with the appropriate reference, should be addressed to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Fforestfach, Swansea, to arrive not later than 30 Sept., 1961.

R. G. WILLIAMS,
Secretary.
(C 120)

GRADUATE ENGINEERS

(Electrical and Mechanical)

We require one electrical and one mechanical engineering graduate to stimulate and lead investigation work in our engineering laboratory. They will be required to initiate, organise and follow through investigations associated with the application of our products.

Experience of work of a similar nature would be an advantage, but candidates will be judged on their ability to apply original thought and enthusiasm to such work.

A contributory superannuation and life insurance scheme is in operation. Positions offered are permanent, and prospects excellent.

Please write quoting Ref. BD/82 to:

The Staff Department,
MORGANITE CARBON LTD.,
Battersea Church Rd,
London S.W.11.

The Morgan Crucible Group

(C 52)

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointment. Applicants should state age, qualifications, experience, etc., and quote the vacancy number.

Lincolnshire Sub-Area

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER

LINCOLN DISTRICT

Vacancy No. 110/61.

Salary: N.J.B. Class G, Grade 5, £1,275/£1,410 per annum.

The duties will include assisting in the negotiations for the supply of electricity to consumers, advice on tariffs, electrical installations and appliances, sales activities, control of service centres and consumer service, and the preparation of specifications and estimates for electrical installations and the supervision of contracting work.

Ability to drive a motor vehicle is essential, and the person appointed will be required to live in or near Lincoln.

Applications should be forwarded to The Manager, Lincolnshire Sub-Area, North Hse, Grantham, Lincs, by 29 Sept., 1961.

(C 110)

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

South Western Region

OVERHEAD LINE FOREMAN, GRADE I

ALDERSHOT DISTRICT

APPLICANTS should have extensive experience in the maintenance and construction of steel tower overhead lines operating at 132 kV and 275 kV and have knowledge of the Central Electricity Generating Board Transmission Safety Rules, governing work on high voltage lines, together with previous experience in supervising field work. The successful applicant will be based at the District office but will be required to work within the District boundaries.

Salary: N.J.I.C. Grade 1, Schedule E, £880 per annum.

Applications giving details of education, training and experience should reach the District Engineer, Aldershot District, Lower Weybourne La, Farnham, Surrey, by Monday, 24 Sept., 1961.

(C 119)

LOCKHEED HYDRAULIC BRAKE CO. LTD.,
and Associated Companies,
Leamington Spa.

ELECTRICAL ENGINEERING DRAUGHTSMAN

Applications are invited from Draughtsmen who have served an electrical engineering apprenticeship and who preferably possess technical qualifications. The position will entail the preparation of electrical drawings for factory services, layouts, specifications and schedules for contract work.

A good commencing salary is associated with this appointment together with participation in profit sharing.

Full details should be submitted to The Employment Officer, quoting Ref. M.3545.

(C 122)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT SECTION ENGINEER

REQUIRED at Rhyl/Rhuddlan in the Board's No. 4 Sub-Area.

Salary within range £890/£1,015 per annum (N.J.B. F/9, Scale 6).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium voltage networks, with their associated substations and equipment.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, near Wrexham.

Closing date: 29 Sept., 1961. (C 108)

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

APPLICATIONS are invited for the position of

ASSISTANT ENGINEER (OPERATIONS)

at Drakelow "B" Power Station. Salary will be in accordance with Class L, Grade 10, £1,190/£1,325 per annum, of the National Joint Board Agreement.

Applicants should possess a Higher National Certificate or equivalent qualifications and have had operation experience in a modern Power Station. Experience of pulverised fuel firing would be an advantage. The successful applicant will be required to act as relief for Assistant Shift Charge Engineers and will then be entitled to the appropriate grade and shift enhancement.

Apply, quoting vacancy number 243/61 MD, on form AE6, available from the Station Superintendent, Drakelow Power Station, nr. Burton-on-Trent, Staffs. Closing date for receipt of applications is 25 Sept., 1961. (C 103)

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION

West Indian Engineers who are interested in careers with the Trinidad and Tobago Electricity Commission are invited to write to the Secretary and Personnel Manager, P.O. Box 121, Port-of-Spain, Trinidad, West Indies. There are good opportunities for young West Indian Nationals with degrees in Electrical or Mechanical Engineering or who are Graduate Members of the Institution of Electrical Engineers. Commencing Salary £1,050 per annum. Experience not necessary but candidates **must** be qualified. (C 124)

YORKSHIRE ELECTRICITY BOARD

Applications are invited for the post of SUB-AREA MANAGER in each of the following:

No. 3 (Sheffield) Sub-Area (E.10, £3,765/£4,020 per annum).
No. 2 (Huddersfield) Sub-Area (C.10, £3,270/£3,515 per annum).
No. 7 (Grimsby) Sub-Area (B.10, £3,040/£3,270 per annum).

Applicants, who should have extensive knowledge of the industry and a wide experience in the organisation of large units of electricity supply, should state age and full details of qualifications and experience and should also indicate the appointment or appointments for which they wish to be considered.

Applications should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, Leeds, not later than Friday, 29 Sept., 1961. (C 36)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

ASSISTANT SECTION ENGINEER

REQUIRED at Aberystwyth in the Board's No. 4 Sub-Area.

Salary within the range £825/£940 per annum (N.J.B. E.9, Scale 5).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium voltage networks with their associated substations and equipment.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, near Wrexham.

Closing date: 29 Sept., 1961. (C 109)

LONDON ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEER

APPLICATIONS are invited for the above position in the Board's Borough District at 15 Penrose St, S.E.17.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

Housing accommodation could be made available to the successful applicant.

The post is graded under Schedule A of the National Joint Board Agreement as Class H, Grade 9, £1,090 per annum, rising to £1,215 per annum, inclusive of London Allowance.

Applications stating age, qualifications and experience should be sent to the Manager at the above address within 14 days of the publication date of this notice. Please quote ref.: PER/V/3387/T. (C 113)

ELECTRICAL ENGINEERS

required by the United Kingdom Atomic Energy Authority, Dounreay Experimental Reactor Establishment, Thurso, Caithness.

Vacancies exist for an Electrical Distribution Engineer to be responsible for the control, operation and maintenance of 11 kV, 3·3 kV and 415 V distribution and generation systems and for an Electrical Maintenance Engineer to be responsible for the maintenance and installation of electrical plant in process buildings.

Applicants must have served a recognised engineering apprenticeship and be corporate members of the Institution of Electrical Engineers or equivalent. For the post of Electrical Distribution Engineer, experience of permit-to-work systems, maintenance of switchgear and protective gear and control of turbo-alternator plant is essential. Experience of maintenance of motors and switchgear and of installation of plant is essential for the post of Electrical Maintenance Engineer.

Salary between £1,560/£2,090, according to qualifications and experience.

Rented housing and house purchase assistance available for married officers living beyond daily travelling distance. Single accommodation available. Contributory Superanuation.

Send postcard for application form to the Personnel Manager at the above address quoting reference 295/49. (C 114)

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

ELECTRICAL ENGINEER'S DEPARTMENT

FOURTH ASSISTANT ENGINEER

(TECHNICAL), D.H.Q.

Amendment to Vacancy No. 236/61

OWING to re-classification the salary scales quoted should be amended to read as follows:

London Area: £950/£1,215 per annum.

Outside London Area: £900/£1,165 per annum. (C 116)

CITY OF LIVERPOOL EDUCATION COMMITTEE

North East Liverpool Technical College

APPLICATIONS are invited for the appointment of

PRINCIPAL

of the above College. Salary: £2,050 x £50—£2,150.

The College which is completely new, is scheduled to open in September, 1962. It will offer O.N.C. courses in Mechanical Engineering, Electrical Engineering, Building, Paint Technology and Rubber Technology. The average daily attendance is expected to be about 600 students.

Applicants should have a graduate qualification in Engineering or Science and should have held a position of responsibility in an establishment of Further Education. Duties will commence on 1 Jan., 1962, or as soon after that date as possible.

Further particulars and application forms (returnable by 11 Oct., 1961) from The Director of Education, 14 Sir Thomas St, Liverpool 1.

THOMAS ALKER,
Town Clerk.
(J6982). (C 78)

ELECTRICAL SALES ENGINEER

(A.M.I.E.E. at least)

A new appointment to promote the use of aluminium foil and strip in transformer and magnet windings as well as other applications, requires a man over 30 years of age with sales experience and a knowledge of winding designs. The appointment, which offers plenty of scope, is based on London. Right salary will be paid for the right man. Box No. 8407, Electrical Times. (C 44)

CENTRAL ELECTRICITY GENERATING BOARD

Western Division

Vacancy Notice ET/AV/87/61.

Second Assistant Station Chemist required in respect of the combined chemical services of Portishead "A" and "B" Power Stations.

Superannuation Scheme. Salary: N.J.B. Class L, Grade 11, Scale 9, £1,115/£1,245 per annum.

Candidates should possess H.N.C. (Chemistry) or equivalent qualification and should have had experience in the chemical control required on a large modern power station. A knowledge of the various mechanisms of corrosion and of oil firing and its associated problems would be an advantage.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 25 Sept., 1961. (C 99)

AYRSHIRE EDUCATION AUTHORITY

INVITE applications for the following posts in Ayr Technical College:

TEACHER OF ELECTRICAL ENGINEERING

Applicants should hold an Ordinary Degree in Electrical Engineering or Associate Membership of the Institution of Electrical Engineers, or A.R.C.S.T. in Electrical Engineering. Teaching experience and/or practical experience in the Electrical Contracting Industry would be an advantage. Salary on scales: £785/£1,420 or £685/£1,290 according to qualifications, with an additional £65 per annum for approved teacher training.

TEACHER OF ENGLISH AND SOCIAL STUDIES

Chapter V or Article 39. Salary scale for Honours Graduate: £960/£1,750, and for Ordinary Graduate: £785/£1,420 with an additional £65 per annum for approved teacher training.

Forms of application are obtainable from the Director of Education, County Bldgs, Ayr, to whom the completed forms should be returned not later than 23 Sept., 1961. (C 79)

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

SHEFFIELD CENTRAL DISTRICT

SECOND ASSISTANT DISTRICT ENGINEER

APPLICANTS should have had experience in the work of a District Engineering Department, including construction, operation, maintenance and planning.

Salary: N.J.B. Class H, Grade 7 (Scale 10), £1,190/£1,325 per annum.

Applications, together with the names of two referees, should be sent to the Manager, Yorkshire Electricity Board, No. 3 (Sheffield) Sub-Area, Change Alley, Sheffield, not later than 29 Sept., 1961. (C 98)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Stirling Area

APPLICATIONS are invited for the undernoted appointment:

SECOND ASSISTANT COMMERCIAL ENGINEER

(Ref. No. 52/61)

for the Falkirk District of this Area.

Candidates should have had a sound practical training in electrical engineering and be experienced in the work of a commercial department of an electricity supply undertaking, especially in the use of electricity for space and water heating. The possession of a Higher National Certificate would be an advantage.

N.J.B. Conditions. Salary: Class G, Grade 7, £1,115/£1,245 per annum. Superannuable post.

Applications, on the standard form, obtainable from the Area Manager, S.S.E.B., "Woodlands," St. Ninians Rd, Stirling, should be submitted not later than 29 Sept., 1961. (C 106)

APPLICATIONS are invited by Kennedy and Donkin, 12 Caxton St, London S.W.1 (Ref. RFL), for an ASSISTANT in the Cable Department at their Weybridge Office. Applicants must be qualified electrical engineers with experience in design, manufacture and installation of cables for transmission and generation projects. (C 68)

ELECTRICAL SUPERVISOR required for responsible position with a company engaged on Nuclear Power Station construction. The successful applicant will assume control for electrical and associated work on the company's sites. Write, giving age, precise details of previous positions held, qualifications and required salary to Box No. 8417, Electrical Times. (C 91)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

FULLY experienced JOURNEYMEN CABLE JOINTERS required by large electrical company. Applicants would be required to travel to any part of the country. London rates of pay and out allowance. Write stating age and giving brief details of experience to Box No. 8409, Electrical Times. (C 51)

JOINTER (E.H.T.) required. Previous experience essential. Present rate of pay 5s 6½d per hour, N.J.I.C. conditions, including 42-hour, five-day week. Holiday and sick pay schemes. Optional superannuation scheme. Apply by letter to District Manager, Midlands Electricity Board, 31 High St, Stourbridge, Worcs. (C 111)

MANUFACTURERS of Cable Trunking require AGENTS with well-established connections in Eastern, Southern and Western Counties. State in confidence details of lines already represented and areas worked. Box No. 8415, Electrical Times. (C 90)

MECHANICAL FITTER/ASSEMBLERS required for assembly of medium and large size On-load Tap Changers for transformers. High piecework earnings possible. Apply personally or in writing to the Works Employment Officer, Fuller Electric Ltd., Fulbourne Rd, Walthamstow, London E.17. LAR 2350. (C 19)

NEWTON BROTHERS (DERBY) LTD. require SALES ENGINEER for employment at their Derby Works.

Applicants must have had sound technical training and previous experience in handling inquiries relating to a.c. d.c. rotating machines and control gear.

Apply giving details of age and experience to the General Manager, Newton Bros. (Derby) Ltd., Alfreton Rd, Derby. (C 25)

POLYPHASE TEST. Experienced TESTERS or IMPROVERS. These vacancies afford unique opportunity for experience on calibration of a wide range of integrating electricity meters and ancillary equipment. Staff status after qualifying period. Please inquire: Personnel Manager, Landis and Gyr Ltd., Victoria Rd, North Acton, W.3. Acorn 5311. (C 115)

SENIOR TRANSFORMER DESIGNER with experience of various types up to 5 MVA. This appointment carries a very realistic salary and scope for the future for the right man between 30-40. A company house is available if required. Factory is situated in ideal rural surroundings four miles from the sea. Apply Chief Designer, London Transformer Products Ltd., Bridgend. Glam. (C 13)

RESIDENT ELECTRICAL ENGINEER for a half-million pound electrical installation in a new commercial building in Kensington area.

Applicants must have experience of electrical contracting industry on projects of a similar size and nature, and should be not less than 35 years of age.

Term of Contract approximately two years. Applicants must give details of training, experience and position with present employer. Please state salary required. G. H. Buckle and Partners, 2 Harrington Gdns, London S.W.7. (C 123)

APPOINTMENTS WANTED

AUTOMOTIVE CONTROL GEAR REPRESENTATIVE requires change.—Box No. 8411, Electrical Times. (C 74)

WORKS MANAGER desires similar position. Electrical Engineer wide experience and successful record with medium size company. Present contract expires December. Box No. 8419. (C 125)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (C1)

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A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, Switchgear, Exhaust Fans, Hoists, Reduction Gears, new or reconditioned units.—CHI 5105, 67 Rothschild Rd, W.4. (C 2)

A.C. AND D.C. MOTORS, Generators, new and reconditioned. REWINDS and repairs promptly executed.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566. (C 8)

A.C. AND D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½-100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton, Elmbridge 2234/5/6. (C 7)

BENJAMIN PROJECTORLUX FITTINGS. Catalogue Nos. 5080/5077/5079 as new.—Please apply Box No. 8413, Electrical Times. (C 85)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512/3/3. Stores at Chobham, Surrey. (C 5)

FOR SALE: One seven-panel d.c. vertical flat back type Switchboard, suitable for use on a 220 V two-wire system. Including four generator panels and three-feeder panels with appropriate switches, circuit-breakers and meters. For further details and permission to view apply to: The City Water Engineer, Denton Hse, Iffley Turn, Oxford. (C 46)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (C 6)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment. — Universal Electrical, 221 City Rd, London, E.C.1. (C 3)

NEW Two-phase 90° Angle 200 V Air-cooled Transformer by British Power Transformer Co. Other winding three-phase 120° angle 240 V, 90 kVA load. Purchase price £267. Phone offers to Croydon 3426. (C 95)

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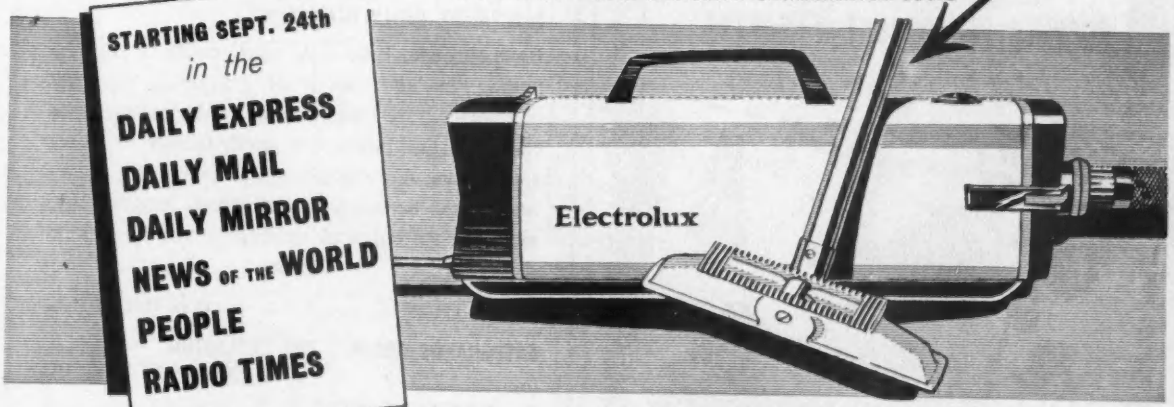

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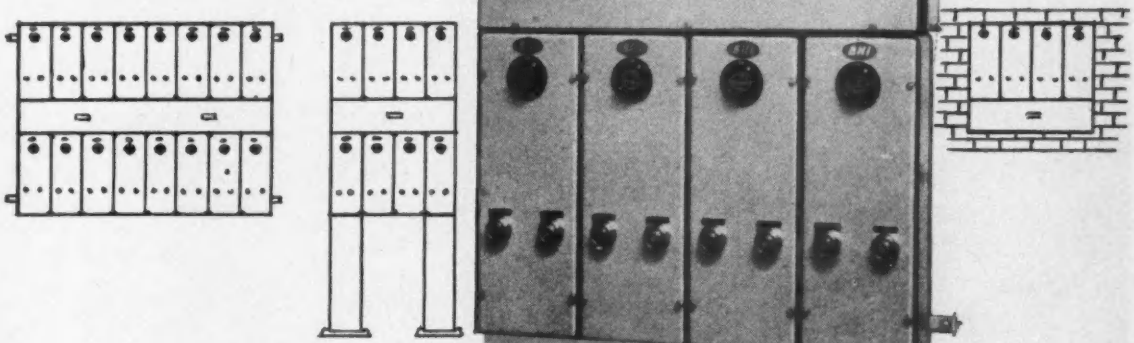

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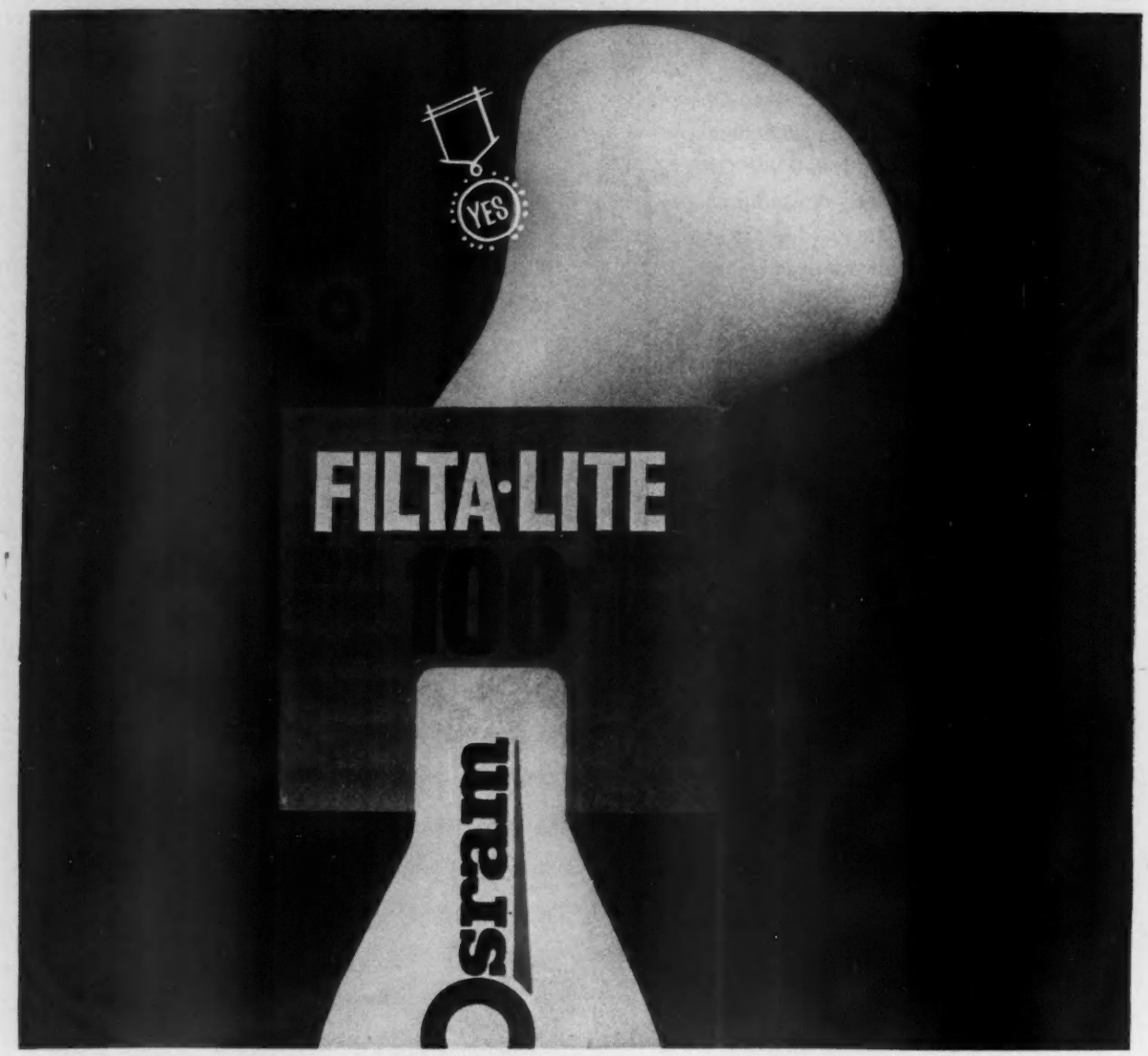

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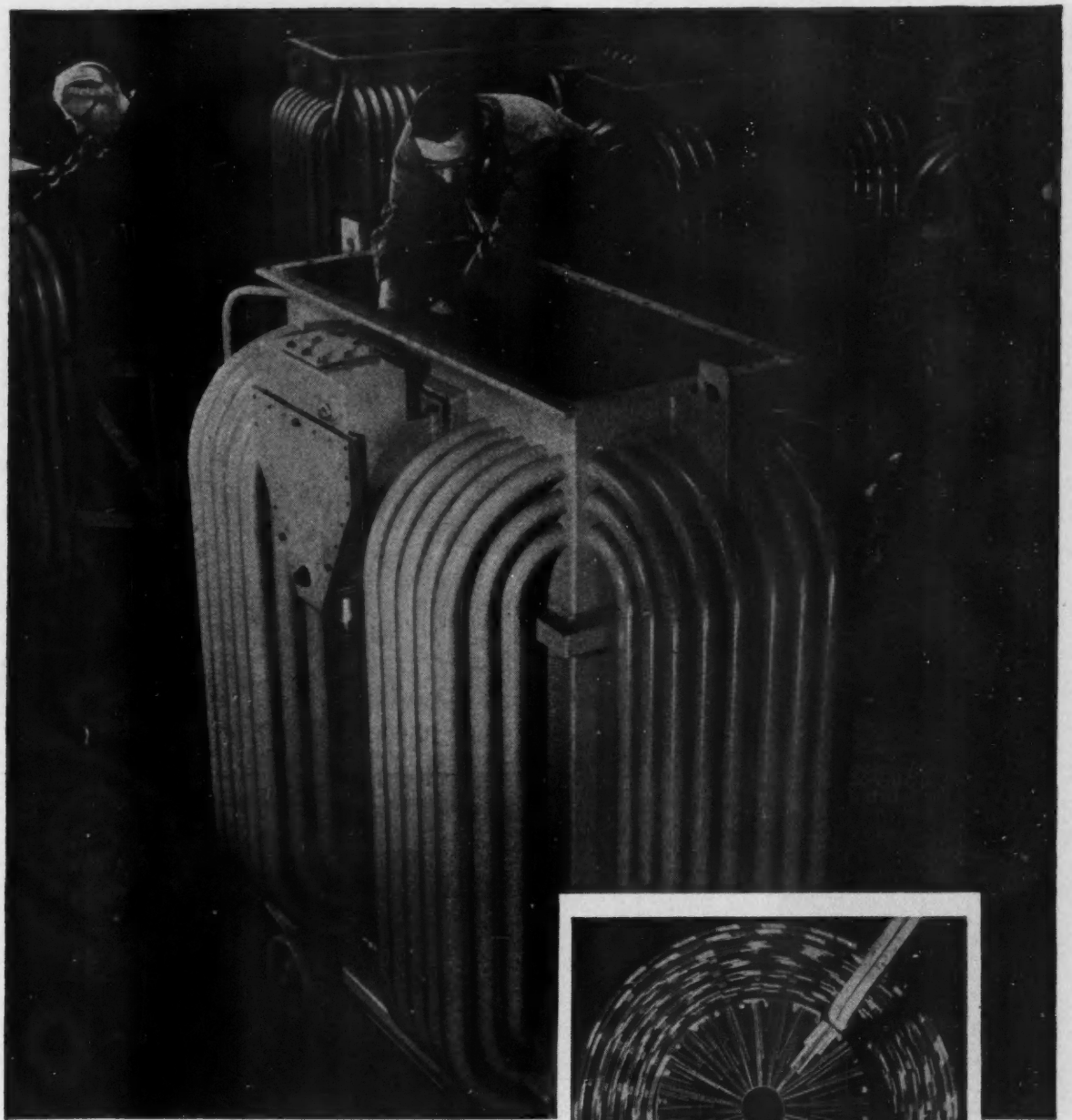

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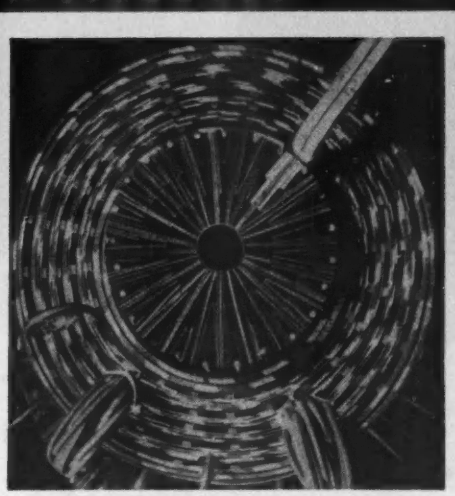

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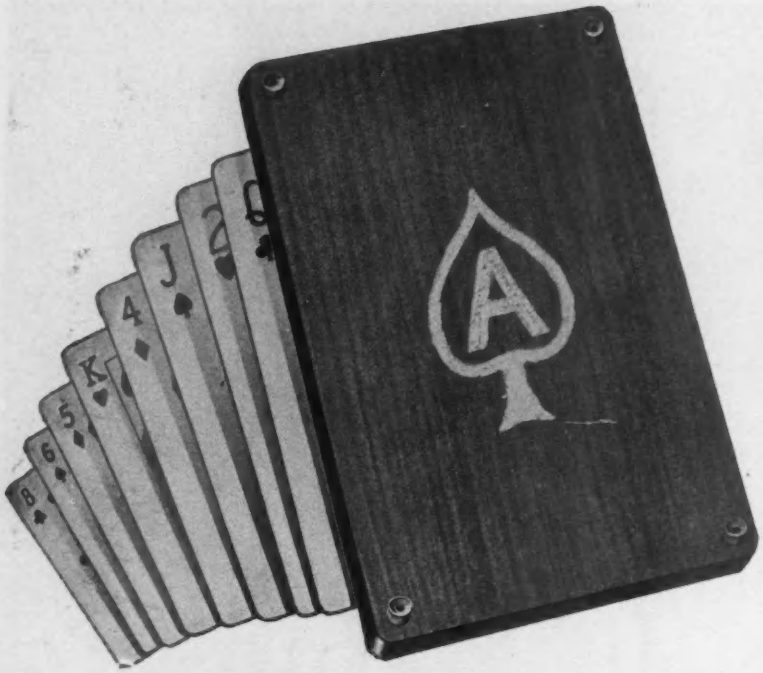

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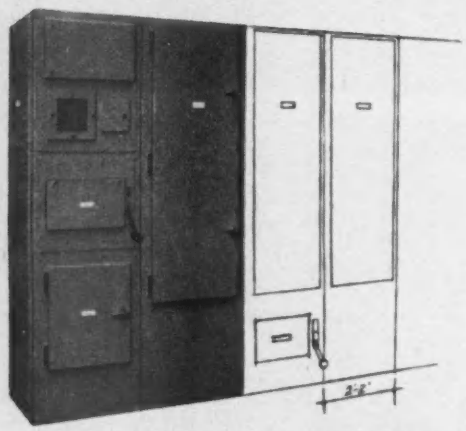

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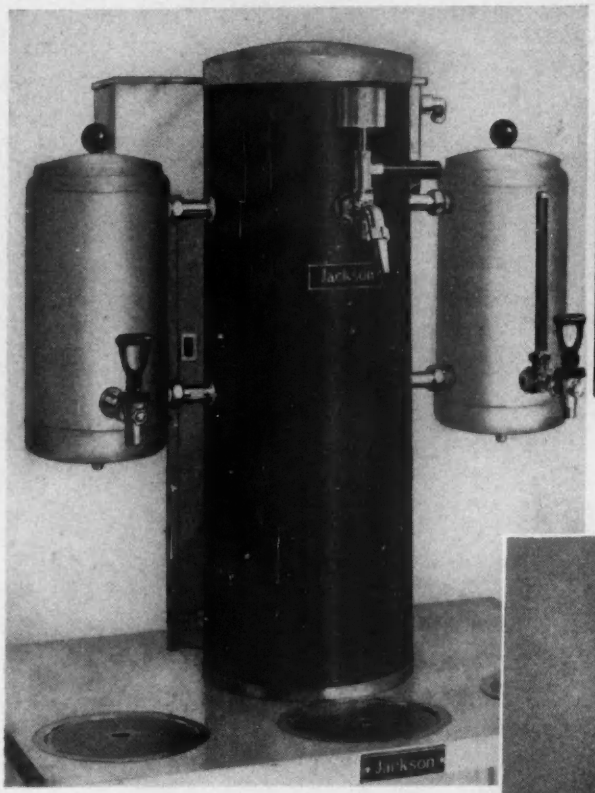

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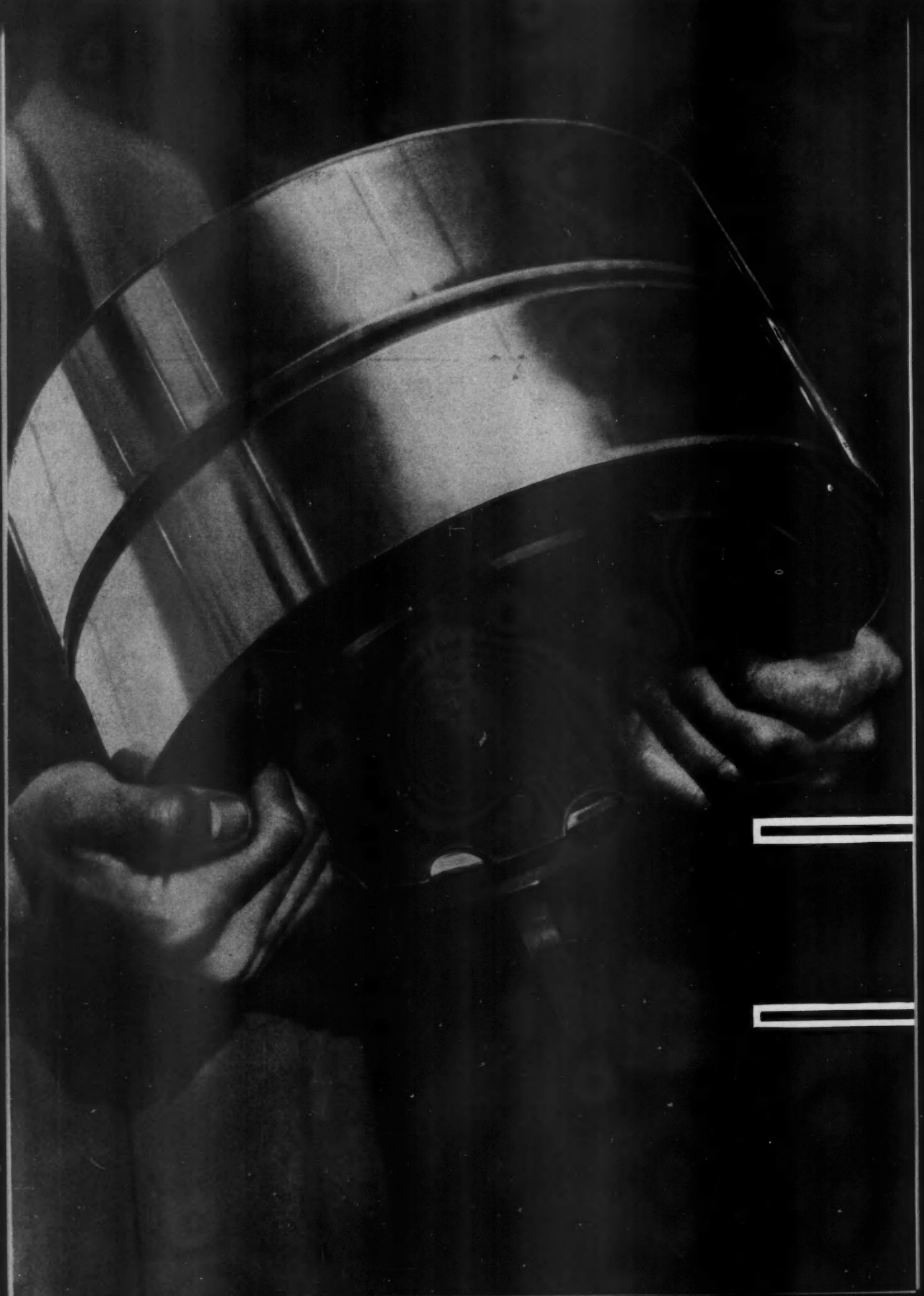
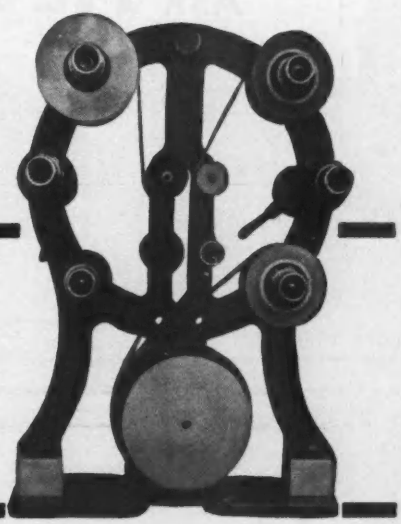


This transformer coil costs less, weighs only half as much– it's wound with **aluminium strip**

Coils wound with aluminium strip not only have better electrical and thermal characteristics: they are simple to make and show appreciable savings in material costs. Because they have none of the air spaces unavoidable with round wire, they are generally no larger than wire-wound coils of equal power and weigh only half as much. If you would like to know more about strip windings, or other uses of aluminium in the electrical industry, get in touch with any of the Alcan Industries' offices listed below.



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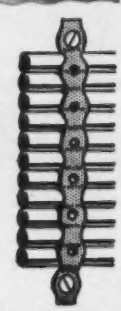

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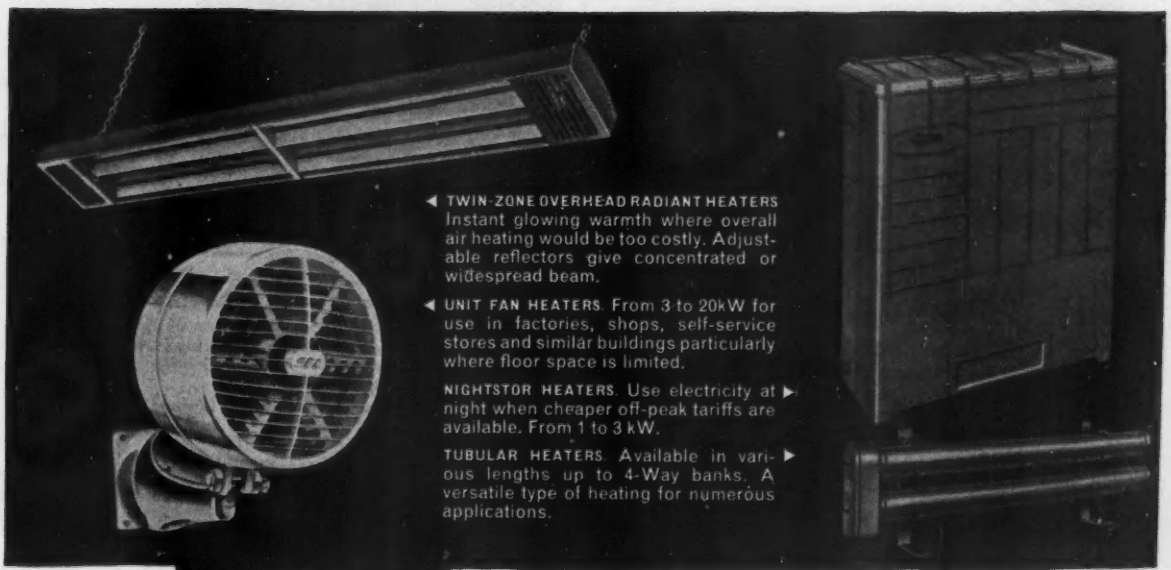

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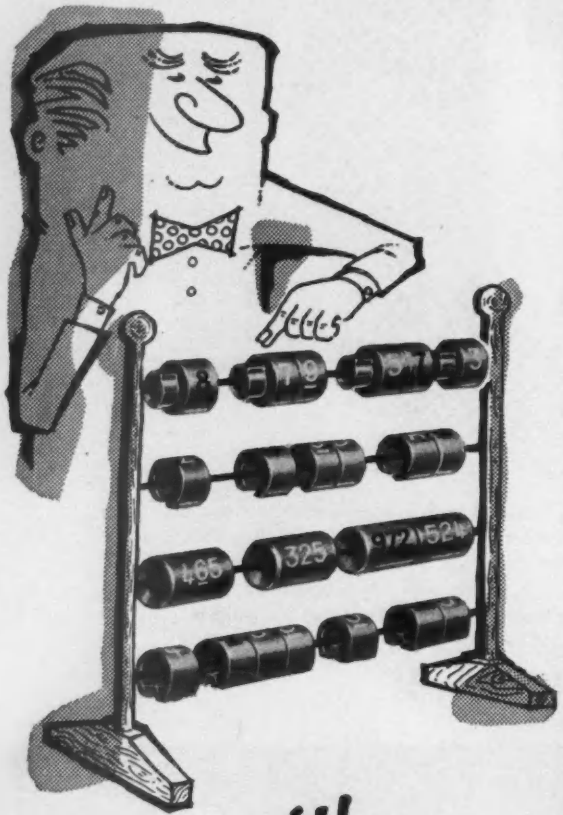

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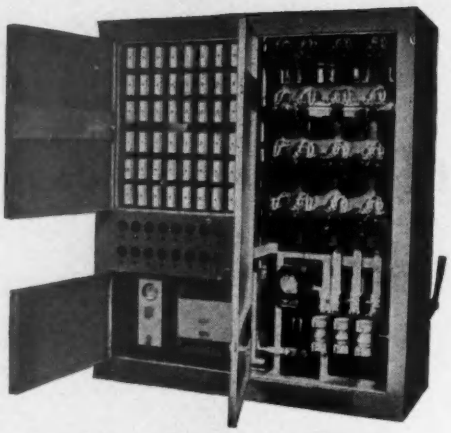

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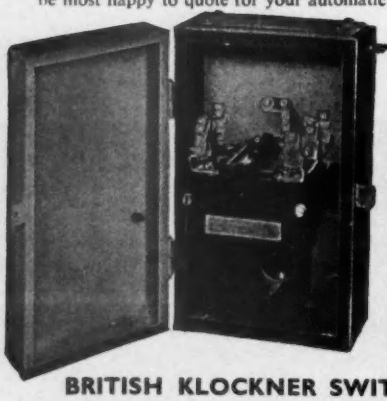

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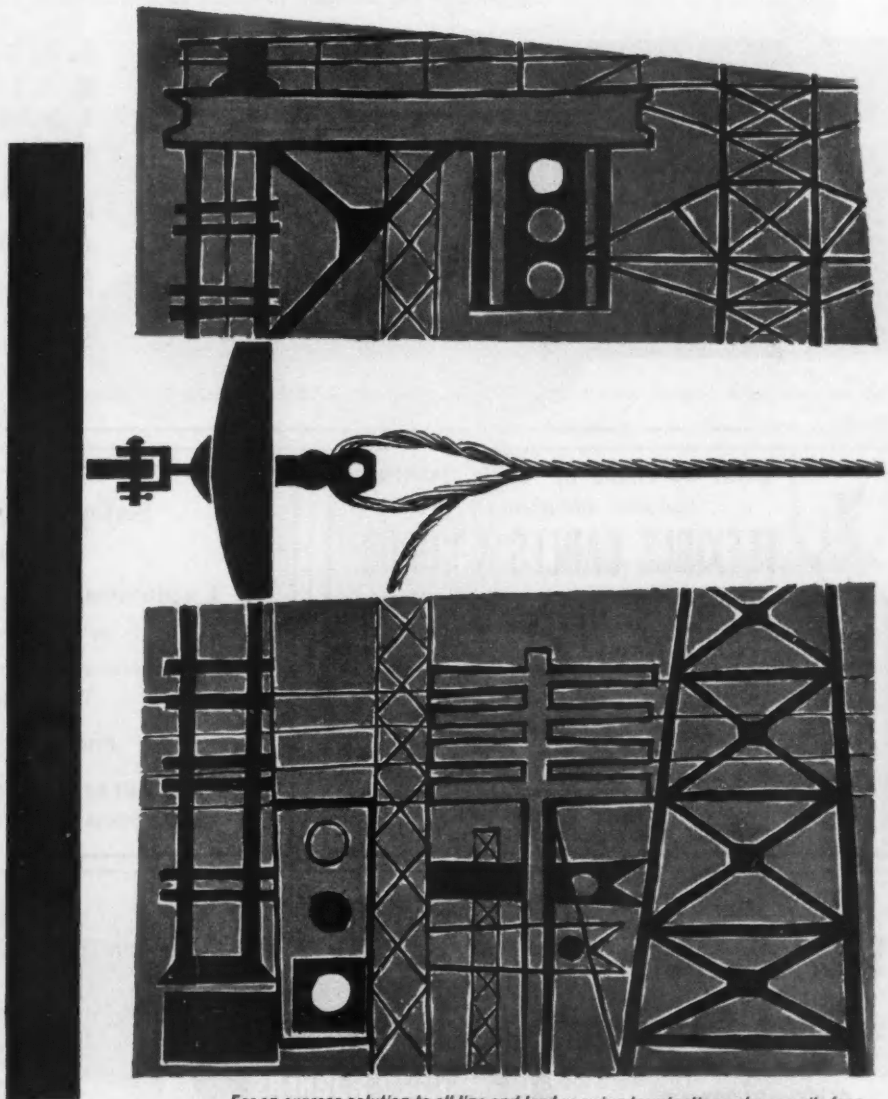

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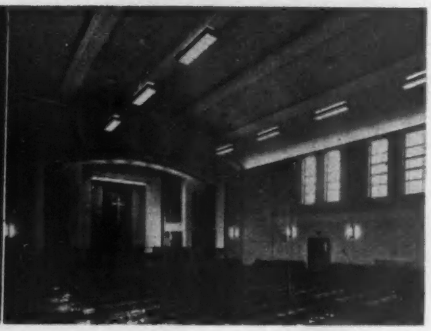

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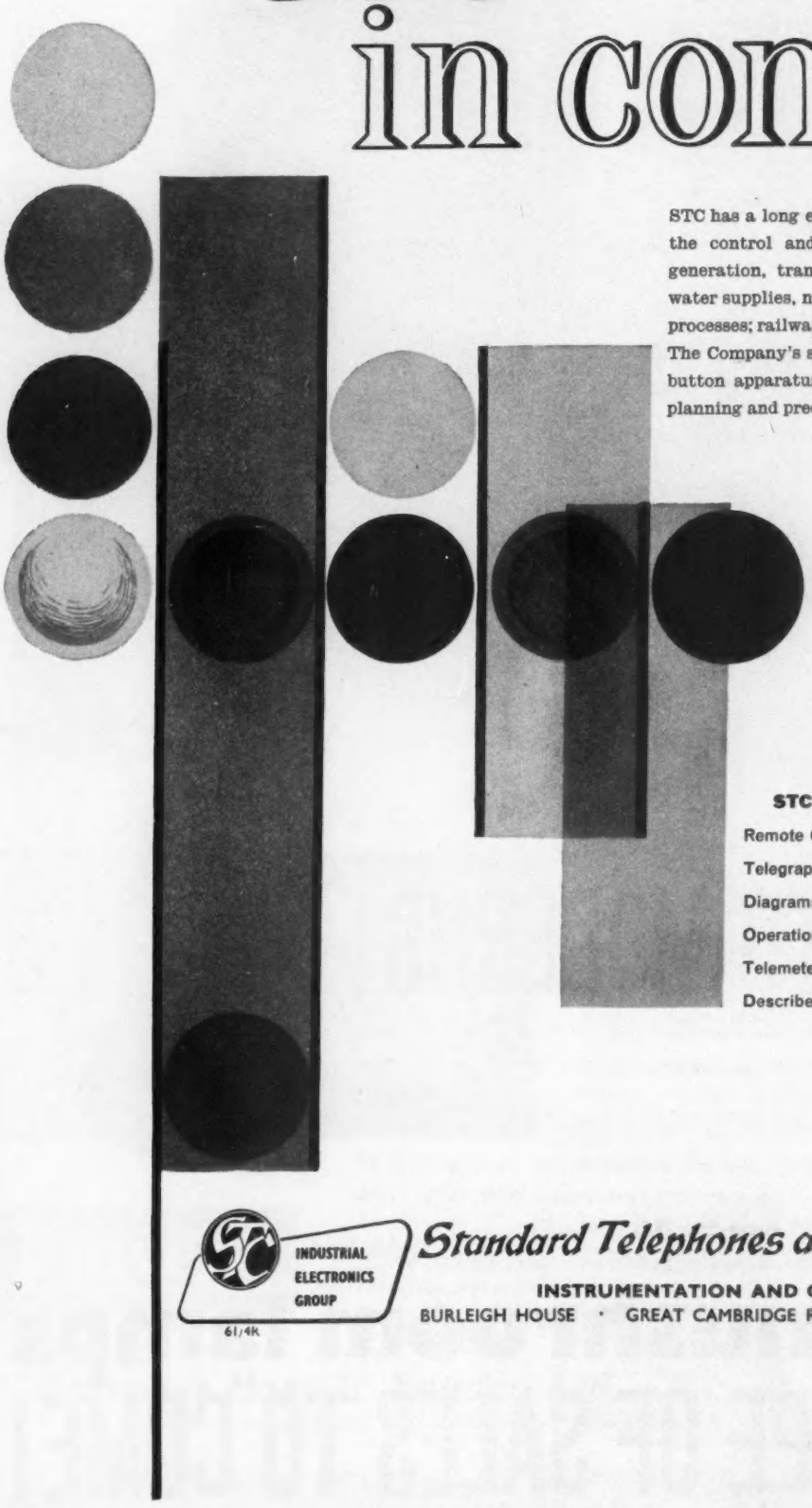

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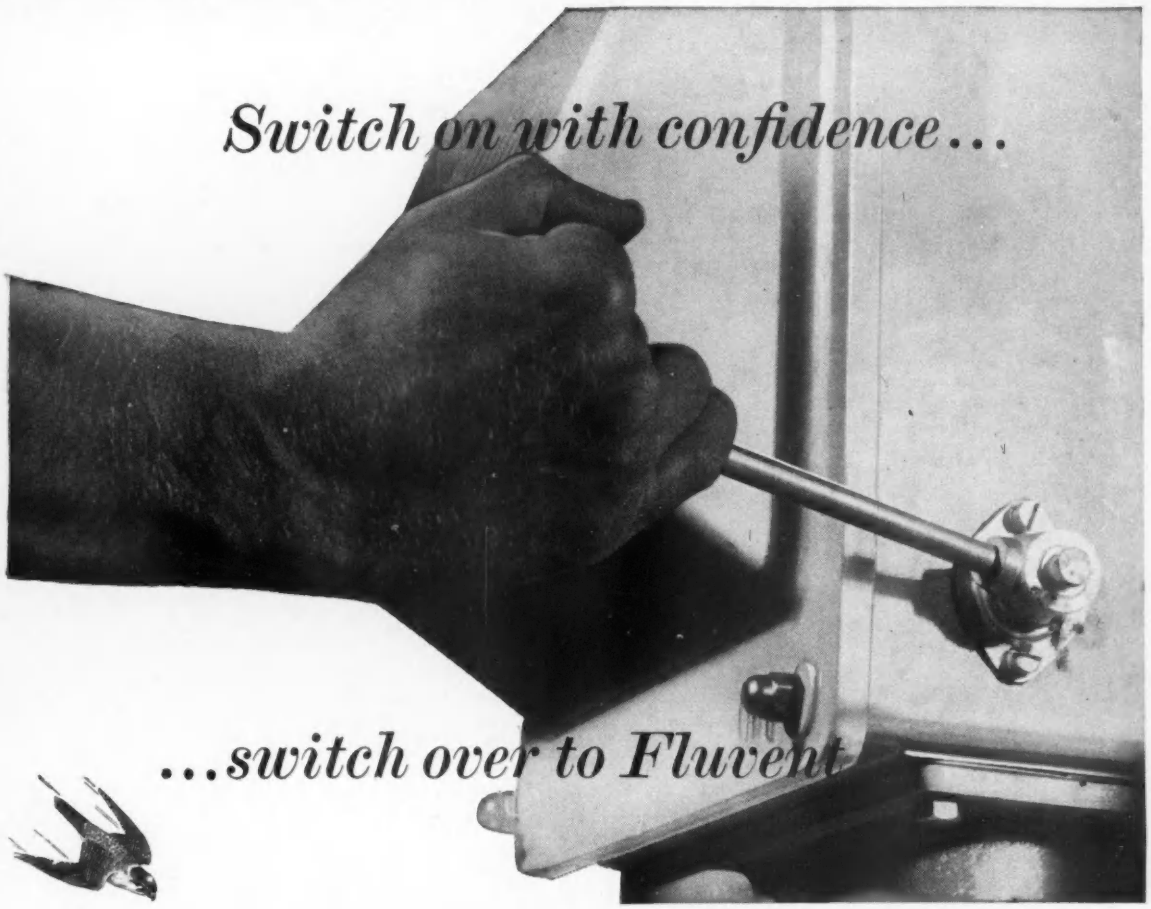

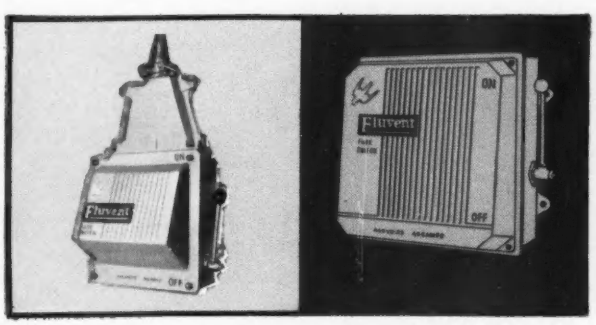

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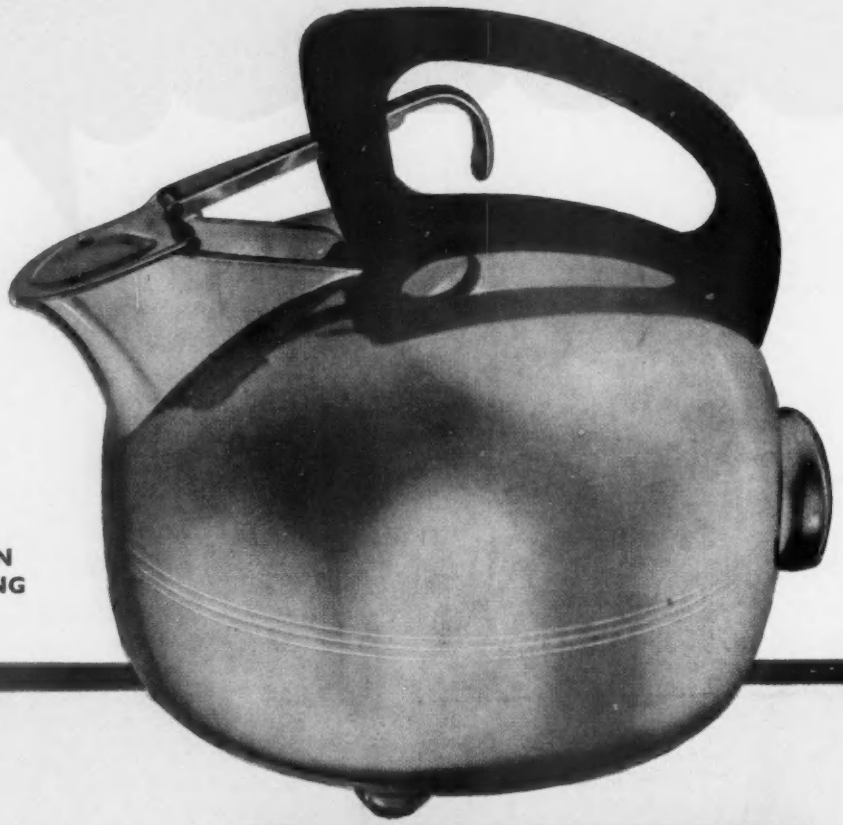

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